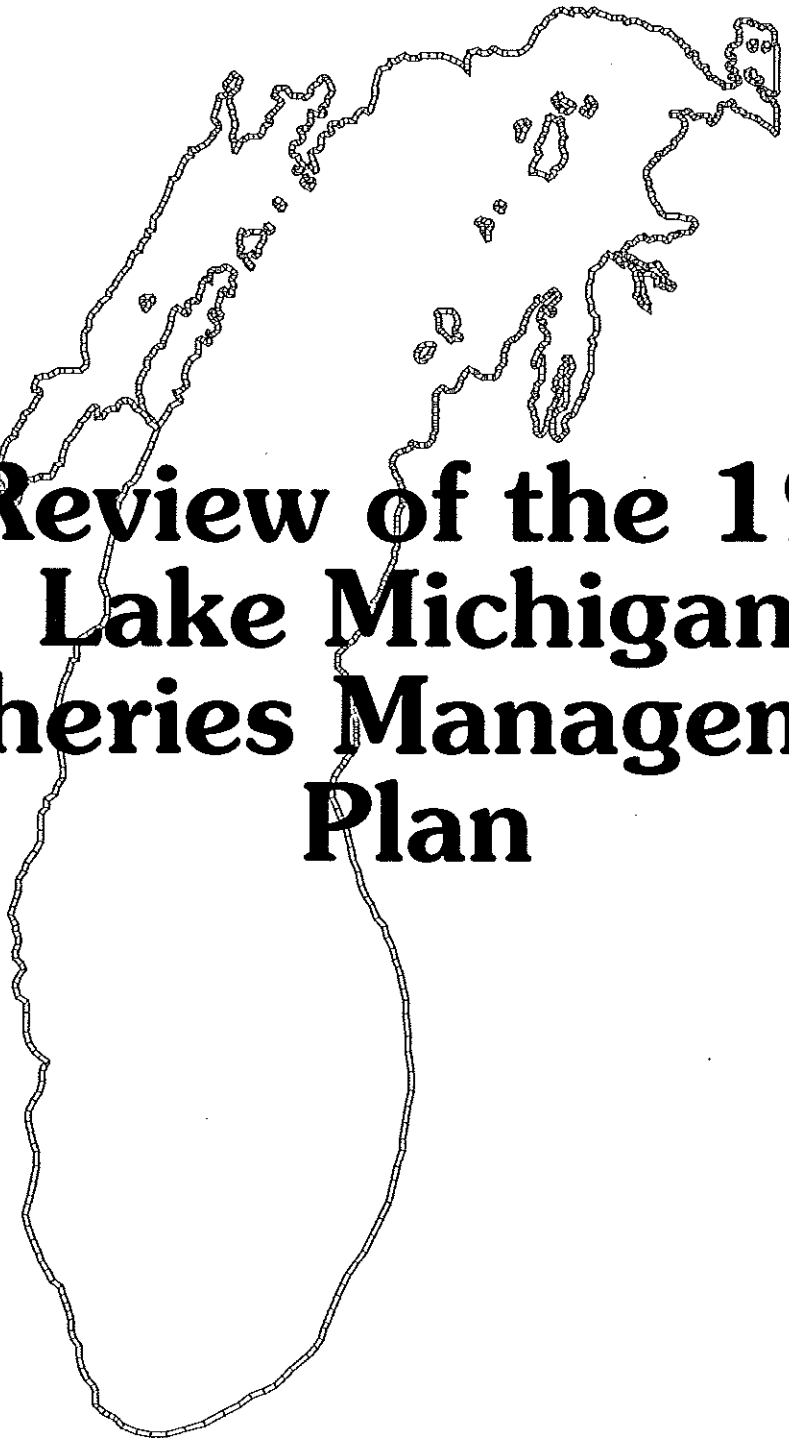
Administrative Report No. 34



A Review of the 1986 Lake Michigan Fisheries Management Plan

November 1992

Wisconsin Department of Natural Resources
Bureau of Fisheries Management
Madison, Wisconsin

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Administrative Report No. 34

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INTRODUCTION

This is a review of the Lake Michigan Fisheries Management Plan of 1986. The 1986 Plan presents a number of specific **objectives**. For each objective, the 1986 Plan goes on to present **problems** blocking achievement of the objective and **tactics** for resolving the problems. Here each objective from the 1986 Plan is reviewed.

In each review, the rationale as presented in the 1986 Plan is reproduced. That is followed by an overview of progress through 1992. Next, the tactics are assessed. Finally, current issues of concern are briefly stated.

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Objective A.1: Manage the lake whitefish population at levels that will allow a sustained annual harvest of at least 650,000 pounds.

Reviewed by Mike Toneys

Rationale (from the 1986 Plan):

Since 1973, the lake whitefish harvest in Wisconsin waters of Lake Michigan has averaged 1.1 million pounds annually. For the 60 years preceding 1973, the annual harvest averaged less than 400,000 pounds. According to an ongoing university study, the current harvest, combined with the harvest by Michigan fisherman in Green Bay, may be at or near the maximum safe harvest limit for this shared stock. Furthermore, history suggests that the unusually long series of strong year classes that has supported abundant harvests in recent years will not continue.

The 1991 goal of 650,000 pounds was set at a conservative, intermediate level, based primarily on the above factors. Management will be geared toward stabilizing the population, and thus the harvest. Managers will view harvests dropping below the 650,000 pound optimum as indicators of potential problems with the fish stock, which may require additional regulations.

For the past ten years, more than 100 fishers annually have reported harvesting whitefish. However, the combination of limited entry and license fee increases could reduce the number of fishers by at least one half by 1991. Those remaining would probably be the serious, full-time fishers who currently report the highest individual poundage. In addition, calculations indicate that these fishers will probably be the most efficient. The net result should mean less gear fished and consequently a reduced incidental catch of salmonids.

Overview of progress through 1992:

The objective of managing for a whitefish population which can sustain an annual harvest of 650,000 pounds has been exceeded. From 1986-1992, the harvest in Wisconsin has averaged 1.04 million pounds. From 1989 through 1991 the harvest has been limited by a zone quota system with a total quota of 1.15 million pounds. Due to increased production in the stock and a decrease in incidental salmonid catch, the total quota was recently raised to 1.3 million pounds. Trends in population statistics have been kept current. There has been a decline of only 18% in the number of active fishers since 1986, not the 50% predicted when this plan was first drafted.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Discontinuation of UW-Stevens Point (UWSP) whitefish studies will result in inadequate data to manage the fishery.

Tactic: Increase Department entrapment gear assessments of the whitefish population in spring and fall.

We have in place a successful assessment plan using both entrapment gear and gill nets for the recruited portion of the stock. Trends in growth, mortality, and relative abundance established through UWSP studies have been kept current through DNR assessments. We are still working on improving the assessment of juvenile fish.

Tactic: Apply models developed by UW-Stevens Point where appropriate.

The STOCK ASSESSMENT PACKAGE (SAP) computer model developed by Michigan DNR has been used successfully as a tool to set quotas. Advice on the use of this model and interpretation of results was provided by biologists from MDNR and UW-Stevens Point.

PROBLEM 2: Overharvest of North-Moonlight Bay stock may result in excessive effort or weak year classes.

Tactic: Identify when overharvest of stock is occurring. If overharvest occurs, develop and implement a management plan with Wisconsin whitefish fishers to control overharvest.

An adjustable allocated quota system, with zones suggested by commercial fishers, was put into effect in July 1989. This regulation change, which has increased protection of the stock from overharvest, was necessitated by: 1) movement of displaced Michigan commercial fishers into Wisconsin's whitefish fishery and 2) increasing trap net effort in previously lightly fished areas off Two Rivers and Sheboygan. We accomplished additional stock identification studies near these central lake ports, which supported the concept of primarily one stock contributing to Wisconsin's harvest.

Tactic: Work with other jurisdictions to prevent overharvest of shared stock.

Data from whitefish assessments is regularly shared between Wisconsin and Michigan biologists. And that portion of the Wisconsin stock of whitefish harvested in Michigan waters of Green Bay is included in quota calculations and recommendations.

Issues of concern in 1992:

The expectation by the fishery of an annual adjustment of the quota is not realistic. One year's worth of new data is just not reliable for predicting changes in growth, mortality, abundance, and harvest trends used to calculate a quota adjustment. With a two or three year cycle, we would have more time and data to better interpret stock and harvest trends, resulting in more confidence in the quota adjustment. The Emergency Rule process is still available if changes need to be made sooner.

Whitefish fishers in Zone 3 will probably continue to push for a change in the trap net season. Their proposals range from increasing the season through June to complete elimination of the summer closed season. Fishers claim the current season through mid June is too short and that fall fishing is too dangerous for both gear and personal.

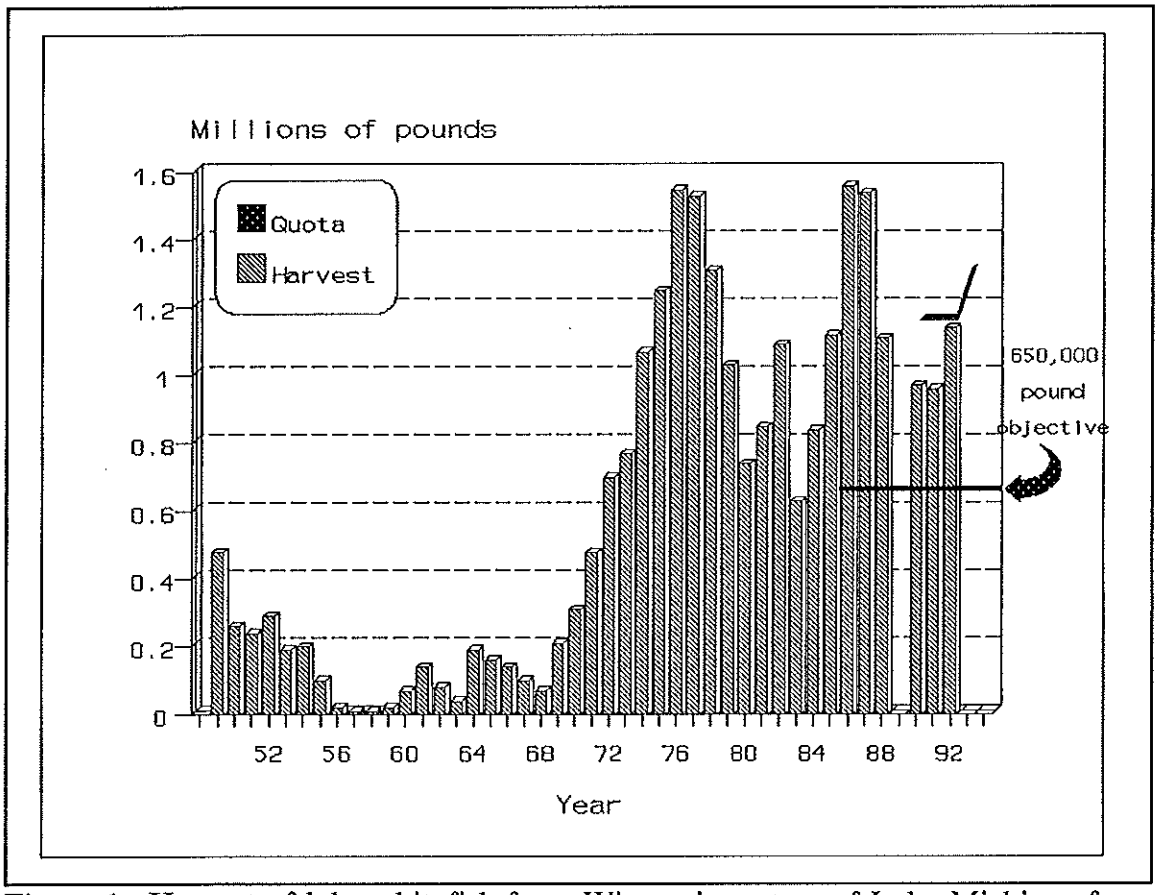

Figure 1. Harvest of lake whitefish from Wisconsin waters of Lake Michigan from 1949 through 1992. The 1986 Plan set an objective of managing the population to allow a sustained harvest of 650,000 pounds. The quota is now 1.3 million pounds.

Objective A.2: Manage the chub population at levels that will allow a sustained annual harvest of 4 million pounds.

Reviewed by Mike Toneys and Tim Kroeff

Rationale (from the 1986 Plan):

From 1935 to 1975, the annual commercial catch of chubs in Wisconsin waters of Lake Michigan averaged about 4 million pounds. The chub fishery remained fairly stable over the years, until the early 1970's, when lamprey predation, alewife competition, and fishing exploitation caused a dramatic lakewide decline in chub stocks. The chub fishery was closed lakewide in 1976 because of the sharp decline.

Between 1976 and 1978, the chub stocks were monitored closely and a strong year class was produced in 1977 and 1978. During the closure, the stocks showed signs of improvement. This improvement in stocks, coupled with the strong 1977 and 1978 year classes, led the Department to reopen the chub fishery under quota management in 1979. The 1979 quota was set at 1 million pounds. Continued increases in stock size and successively stronger year classes from 1977 through 1981 caused the Department to increase the quota to 3 million pounds in 1984. Given the pattern of recovery that chub stocks have shown since 1979 (growth and year-class strength), Wisconsin's Lake Michigan waters should be able to produce 4 million pounds annually.

Overview of progress through 1992:

The objective of managing for a chub population which would allow for a sustained annual harvest of 4 million pounds has been exceeded, with qualifications. The targeted quota of 3.4 million pounds in effect from 1986-1991 was never harvested. The southern and northern zone catches combined averaged 2.09 million pounds annually. However, when the average estimated incidental harvest of 3.56 million pounds from the forage trawl fishery is included, the average total annual removal of chubs increases to 5.65 million pounds. The forage trawl fishery was eliminated after 1990 and the incidental chub removal in the still legal smelt trawl fishery in 1991 was an estimated 631,000 pounds. The southern targeted quota of 3.0 million pounds has never come close to being harvested due to unpredictable and varying market conditions. In the northern fishery the quota was routinely caught and more could have been caught. However, increasing the current quota any more would increase the incidental catch of lake trout which jeopardizes lake trout rehabilitation objectives. The number of fishers holding chub permits has remained around 60 since 1987. Fishing effort by some of these fishers has progressively shifted towards the more profitable yellow perch fishery during that open season in the south.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Unless the chub population expansion continues, the current population

will not sustain a 4-million-pound harvest.

Tactic: Maintain existing harvest controls that will achieve harvest goals without over-exploitation. Implement additional controls as required.

Harvest controls were lessened to take advantage of an expanding population but which still provided protection from over-exploitation. Northern Green Bay and an area between Algoma and Kewaunee were opened. Chub fishing is now opened year-around in the south with seasonal depth restrictions. The northern quota was recently increased by 100,000 pounds to 500,000 pounds total.

Tactic: Continue existing sampling to develop a longer data time series.

The number of fall graded mesh gill net surveys has been reduced from nine in 1986 to three in 1991 due to funding cutbacks, manpower shortages, and disinterest by commercial fishers to accept assessment contracts.

PROBLEM 2: Excessive incidental catch of lake trout may prevent the fishery from achieving the chub harvest goal.

Tactic: Implement regulations that are consistent with the lake trout objectives.

The required use of low-profile gill nets inside 150 feet has increased fishing opportunities while reducing incidental catch of non-target species.

Tactic: Encourage alternative commercial harvest techniques to reduce incidental catch of non-target species.

The only gear besides gill nets that could be fished at depths required to harvest chubs is the trawl. The Department allows sale of some chubs caught in trawls incidental to smelt fishing but has not sought rule changes allowing targeted fishing for chubs with trawls.

Issues of concern in 1992:

We do not anticipate in the future any increase in number of assessments or monitoring. This could delay detection of problems with the chub stocks or incidental catch and the implementation of corrective management actions. To some extent the abundance of chub stocks remains dynamic and at the mercy of changes in abundance of the competing exotic alewife and perhaps the new exotic zooplankton Bythotrephes cederstroemi.

Incidental catch of juvenile chinook salmon in chub nets set in northern Green Bay in December may be higher than previously documented and must be investigated further through onboard monitoring of the fishery.

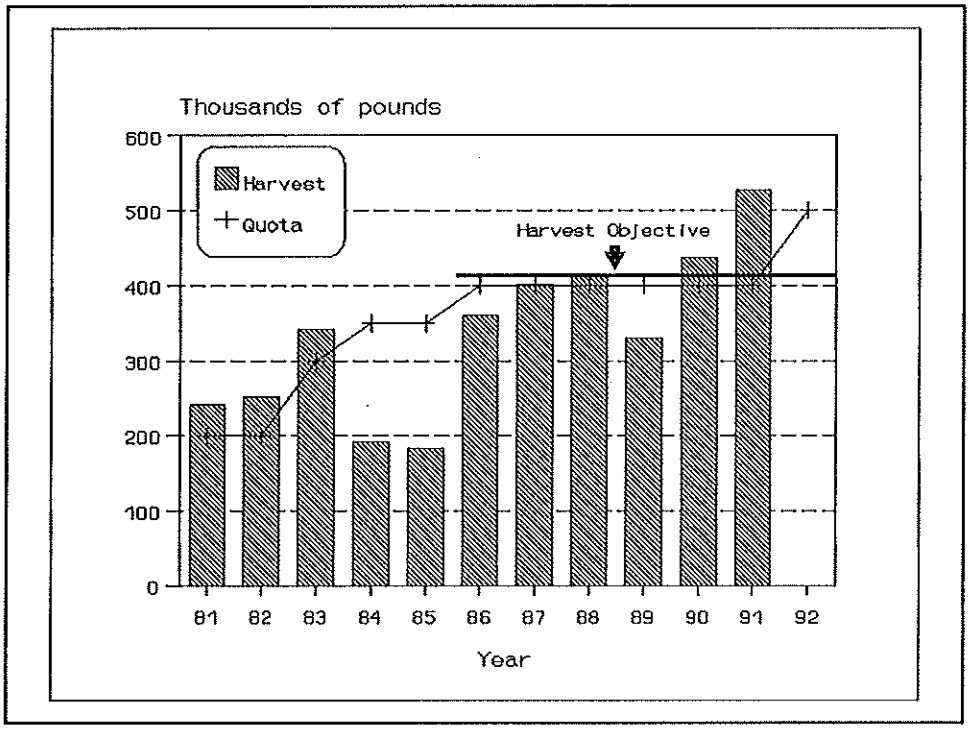

Figure 2. Annual harvest of bloater chubs from the northern chub zone, 1981 through 1991.

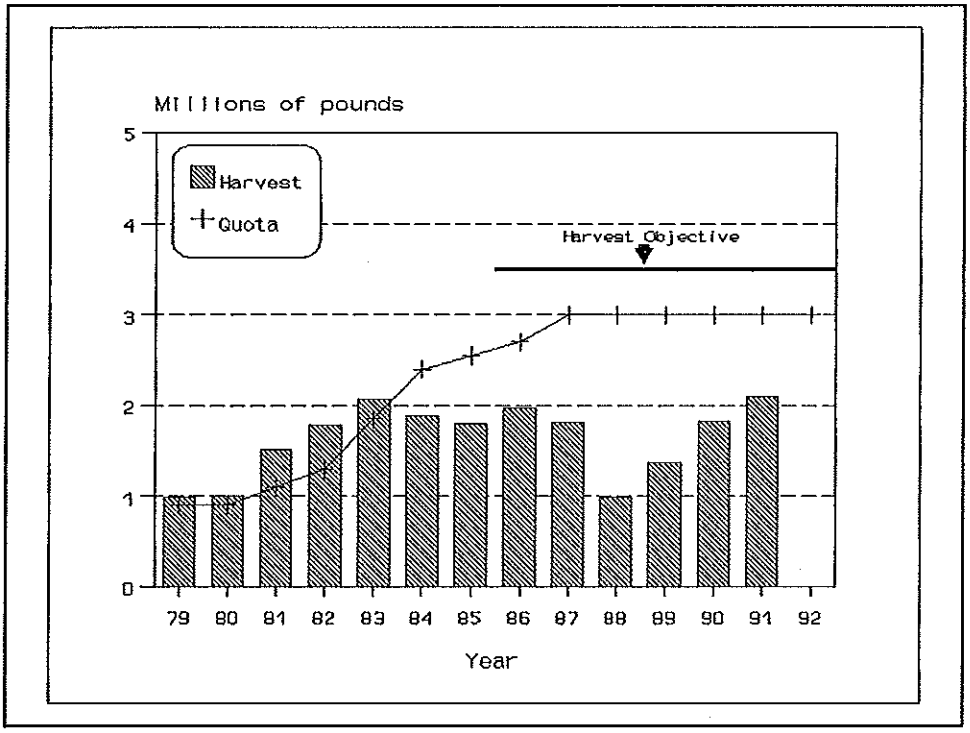

Figure 3. Annual harvest of bloater chubs from the southern chub zone, 1979-1991.

Objective A.3: (first part): Manage the yellow perch population at levels that will allow a sustained annual harvest of 600,000 pounds in Green Bay... .

Reviewed by Brian Belonger

Rationale (from the 1986 Plan):

From 1914 through 1964, commercial yellow perch production in Green Bay averaged approximately 1 million pounds annually and coexisted with a substantial sport fishery. From the mid-1960's to the mid-1970's, commercial yellow perch production averaged approximately 450,000 pounds annually and by the late 1970's, averaged approximately 521,000 pounds annually. Initiation of an age structure will produce an increased average weight-per-fish-harvested (increased yield per recruit). This quota system, combined with reduced mortality due to modifications in fishing nets and a more stable spawning population, will allow maintenance of a more abundant population. Since the 600,000 pound goal is only 15 percent higher than the recent average catch, and considerably lower than the historic average, it is a realistic and conceivable goal under current conditions.

Overview of progress through 1992:

This objective is only part of a harvest objective for yellow perch in southern Green Bay since the resource is shared with sport fishers. The yellow perch population has responded dramatically to the increased protection provided by quota management and other regulations put in place since 1983. The age and size structure of the population has improved and the population is more stable. Population abundance no longer widely fluctuates dependant on the year class strength of two-year old's. Better survival to older ages has dampened the effects of variable year class strengths.

While the overall harvest objective for sport and commercial fishers has been exceeded with a total harvest of approximately 1,184,000 pounds in 1990 and 1,079,000 pounds in 1991 the specific commercial objective of an annual harvest of 600,000 pounds was not achieved. The highest annual commercial harvest(Jan.-Dec.) of 514,000 pounds occurred in 1990 and the highest quotas(July through June license year) of 475,000 pounds occurred in 1989-90 (98.4% of quota actually harvested) and 1990-91 (99.9 % of quota actually harvested). In 1991-92 the quota was reduced to 400,000 pounds to increase protection on the population.

Fishing under the quota system has provided stability in the fishery. Higher abundance of perch has increased efficiency and reduced operating costs. Commercial fishers have individually allocated quotas which allow them the flexibility to harvest those fish over a 258-day per year drop net season and a 300-day per year gill net season. The quota has also contributed to a more stable high price per pound. In 1991, the average reported price per pound was $2.13, which resulted in a landed value of $884,000.00.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Inadequate age structure and abundance prevents attaining harvest objective.

Tactic: Expand stock size and improve age structure through a quota-controlled fishery.

Stock size has been expanded as demonstrated by improved harvest rates. The age structure has improved as demonstrated by the increase in the proportion of ages 3 through 5 in the catch.

Tactic: Develop and implement alternate controls if the quota system is ineffective.

The quota system has been effective as demonstrated by the resurgence of the perch population. Some additional regulations were implemented to limit intentional under reporting of landed catches. Some additional refinements may be necessary.

PROBLEM 2: Excessive non-harvest mortality occurs in the drop net segment of the fishery.

Tactic: Develop and implement recommendations to reduce the mortality.

The commercial drop net season closure period was increased to include May 20 to July 1. The period when water temperatures are rapidly increasing and perch are recovering from spawning stress. A Sea Grant study indicated 55% mortality of sub-legal fish caught in drop nets one day after release. Success of the season restriction is demonstrated by the reduction in dead sub-legal perch washed ashore at transect sites.

PROBLEM 3: Short-term data base restricts predicting effects of regulations on the fishery.

Tactic: Continue existing sampling to develop a longer data time series.

This has been accomplished with continuation of annual index station trawling, commercial catch monitoring and creel census.

PROBLEM 4: Noncompliance with harvest quota will limit management effectiveness.

Tactic: Encourage intensive enforcement.

The point of control for the quota fishery continues to be accurate recording of the estimated catch on bi-weekly report forms prior to reaching dock or shore. Meetings, project proposals and correspondence continue to stress that concept. The most recent fine tuning of the point of control was requiring report forms to be carried in such a manner that the estimated catch could not be manipulated. Also requiring writing down

the estimated catch immediately after all net lifts for each trip and before starting to bring the catch to dock or shore.

Tactic: Monitor the catch via weekly reports to insure compliance.

Weekly reports were converted to bi-weekly reports. Monitoring continues via summaries generated at Sturgeon Bay.

Issues of concern in 1992:

Precise allocation of the yellow perch resource between commercial and sport fishers is not possible. While harvest among commercial fishers is regulated primarily by administration of a poundage quota the sport harvest is regulated primarily through bag limits and seasons. Development of a volatile sport ice fishery has added increased difficulty in anticipating sport harvest levels. Primarily due to ice and weather conditions, ice harvest estimates varied from 82,154 perch in 1989 to 2,059,510 in 1990, 1,846,062 in 1991 and 529,810 in 1992.

The management strategy and approach to allocating the yellow perch resource will have to be re-evaluated in the next management plan.

Green Bay is a dynamic system. Recent introductions of unwanted exotic species such as white perch, zebra muscles, spiny water flea, eurasian milfoil and eventually ruffe will interact with the yellow perch population and the ecosystem. Changing populations of native species will also interact with yellow perch. These interactions are complex, often poorly understood, and difficult to modify.

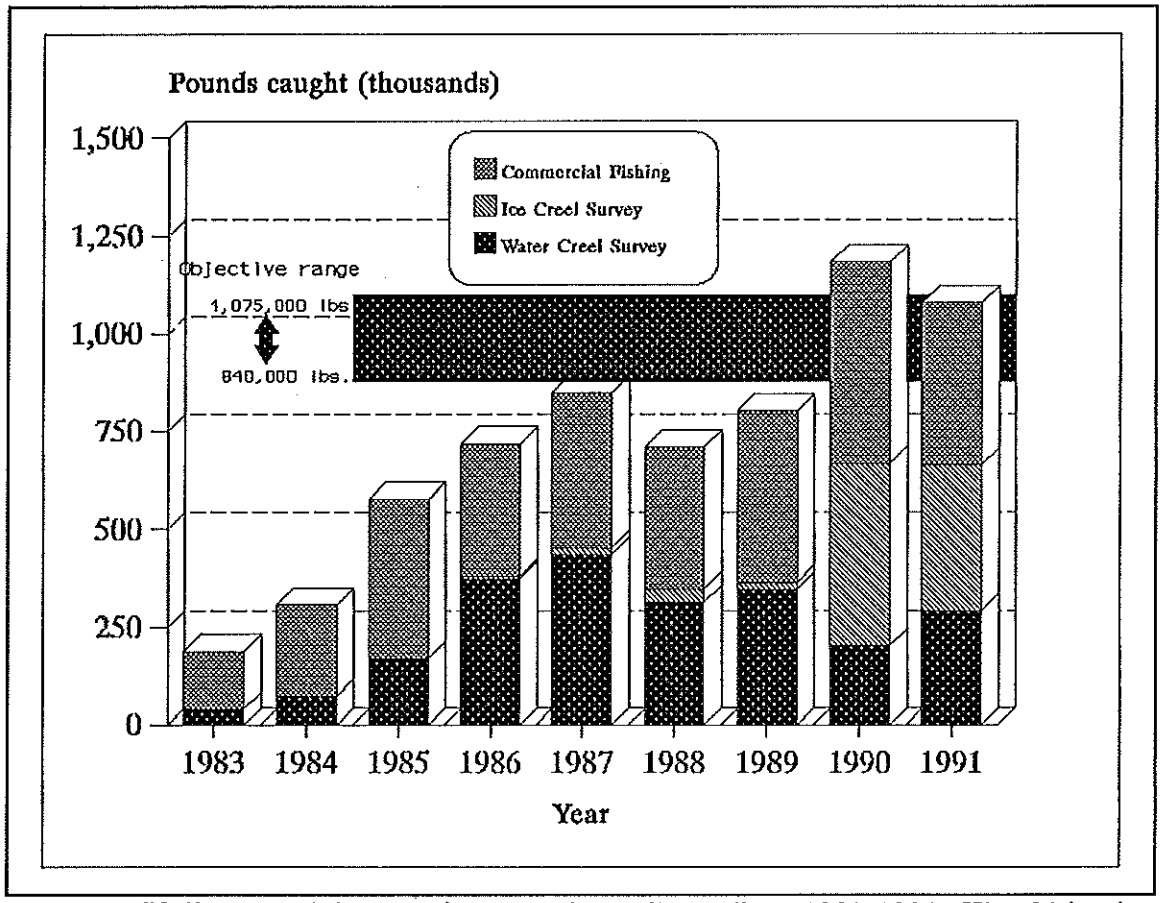

Figure 4. Yellow perch harvest from southern Green Bay, 1983-1991. The Objective range reflects commercial and sport fishing objectives combined.

Objective A.3: (second part): Manage the yellow perch populations at levels that will allow a sustained annual harvest of ... 200,000 pounds in Lake Michigan.

Reviewed by Mike Coshun

Rationale (from the 1986 Plan):

From 1953-1964, the commercial production of yellow perch from Wisconsin's Lake Michigan waters (excluding Green Bay) averaged more than 1 million pounds per year. Some years, the lake's perch population exceeded that of Green Bay. In 1965, production in both the lake and Green Bay crashed, and Wisconsin's Lake Michigan production fell to only 54,000 pounds per year from 1965-82.

Lake Michigan's perch population has been increasing since 1980, however, especially along Wisconsin's southeast coast. In 1983, commercial production exceeded 100,000 pounds for the first time since 1965. With the apparent decline of the alewife population and the recent stronger year-classes of perch, populations should continue to recover. This recovery, accompanied by proper management, should allow an annual commercial harvest of 200,000 pounds.

Overview of progress through 1992:

Annual commercial harvest of yellow perch in Lake Michigan (excluding Green Bay) has exceeded 200,000 pounds each year, since 1984. A commercial harvest quota for that fishery was set at 320,000 pounds per year beginning July 1, 1989. I conclude we have satisfactorily met this objective.

The rationale is in need of updating. Recent harvest trends and population statistics in Zone 3 indicate that we can raise our expectations of what level of harvest we can safely maintain. We need to place greater emphasis on allocation of the estimated safe level of harvest between sport and commercial fishers.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Inadequate data base prevents management decisions based on sound biological information.

Tactic: Develop assessment techniques to characterize the yellow perch population and fisheries.

Sampling protocol in Zone 3 has been fully developed and is functioning satisfactorily. Work has begun to develop adequate population surveys for Zone 2.

Tactic: Coordinate investigations on common stocks with Illinois and Indiana.

We have not yet established to what extent yellow perch stocks are shared by the three jurisdictions. Much work needs to be done in this area. Information and ideas have been shared by the three jurisdictions through the Littoral Fisheries Research Group and the GLFC.

PROBLEM 2: Potential for increasing user group conflict increases as the commercial and sport fisheries expand.

Tactic: Develop a management plan to provide information to the user groups.

Presentations on sampling protocol, analysis procedures and management activities have been developed for the public. A formal plan is needed.

Tactic: Develop and implement regulations to resolve user conflicts.

Regulations implemented in 1989 (closed areas and seasonal restrictions on the commercial fishery together with quota management) have resolved many user conflicts. Commercial fishers continue to push for a return to more liberal seasons and quotas. Allocation of the estimated safe harvest between sport and commercial fishers is the greatest remaining hurdle.

Tactic: Encourage intensive enforcement of regulations to resolve user conflicts.

During the 1991-92 fishing season a combination of dockside monitoring by fisheries staff and efforts by wardens was effective in making great strides in this direction. More work is needed, especially in providing accurate and timely information on harvest and quotas to enforcement staff.

PROBLEM 3: Excessive salmonid removal as incidental catch may put the expanding commercial fishery at odds with sport and lake trout objectives.

Tactic: Encourage alternative commercial harvest techniques to reduce incidental catch of non-target species.

Low profile gill nets and the extension of the closed season to September 15th have minimized the incidental catch problem in the commercial perch fishery.

Issues of concern in 1992:

The extent to which yellow perch stocks are shared by the four states surrounding Lake Michigan is poorly understood. Regulation of harvest differs among the four states. Impacts of changes in those regulations in one jurisdiction on perch abundance in the other states are

unknown at this time.

Interactions between yellow perch and other members of the Lake Michigan fish community are only partially documented. It is generally accepted that in the mid-1960's yellow perch numbers were suppressed by over-abundant alewife. The mechanism for that suppression is still unclear. Obviously, we need to learn more about the interrelationship between perch and alewife and between perch and a whole host of other species.

In recent years a number of unwanted exotic species have been introduced to the Great Lakes including: white perch, zebra mussels, gobies, ruffe, and Bythotrephes cederstroemi. The life history of white perch and ruffe indicates that these species may negatively impact yellow perch abundance.

Yellow perch stocks in the Wisconsin waters of Lake Michigan are shared between commercial and sport fishers. Equitable allocation of the safe harvest is needed.

Objective A.4: Manage the round whitefish population at levels that will allow a sustained annual harvest of 40,000 pounds.

Reviewed by Mike Toneys

Rationale (from the 1986 Plan):

Round whitefish, or "menominee", has never been a primary commercial species for large-scale commercial fishers. For the past 80 years, the annual harvest has averaged less than 60,000 pounds. The conservative goal of 40,000 pounds for 1991 was derived from three factors: population abundance, fisher attrition, and future gear regulations.

Harvest information from catch reports indicates that the annual catch rate has remained relatively stable. It is possible that the species could tolerate a significantly higher harvest, but more research on the biology of this species is needed to substantiate this. Also, markets are quite limited and local, and likely could remain so.

Most round whitefish are harvested by relatively few fishers who use the species as a "fill in" between lake whitefish and chubs. The rest of the harvest is taken by "rowboat" commercial fishers or as incidentals to the yellow perch fishery. By 1992, there will probably be a substantial drop in the number os fishers currently harvesting round whitefish, due to a combination of limited entry and license fee hikes.

The fishery for round whitefish primarily occurs inshore with small mesh gill nets. In the future, this inshore fishery may be restricted to provide additional protection to salmonids, especially lake trout.

Overview of progress through 1992:

The objective of a managing for a round whitefish population which can sustain an annual harvest of 40,000 pounds has been exceeded. From 1986-1991 the harvest in Wisconsin has averaged 41,691 pounds. Since 1989 the harvest has been limited to a zone based, allocated quota totalling 75,000 pounds annually. However, the harvest has lagged substantially behind the quota each year due to lack of widespread interest by the industry in harvesting this species. There has been a 33% decline in the number of fishers for this species from pre-quota 1986 to 1991.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Adequate biological information on the harvested stock does not exist.

Tactic: Continue fall population assessment.

We have continued the fall assessment when weather, gear problems, budgets cuts, and

changing priorities allowed. These have made it impossible to develop trend data on the Bay and Lake populations since some years did not include an assessment.

Tactic: Initiate on-board commercial monitoring to characterize commercial catch, including non-target species.

Since 1986 we have monitored fewer than 10 commercial lifts for round whitefish due to the difficulty of finding lifts to monitor. However, based on the rather scant data collected since 1986, we believe that the population(s) could easily sustain an annual harvest of 75,000 pounds. There has been an additional gear restriction enacted since 1986 (low profile gill nets) to reduce incidental catch of salmonids.

Issues of concern in 1992:

In the future we do not anticipate being able to regularly conduct assessments or monitor the commercial fishery. The problems preventing accomplishment of these tasks mentioned previously are not expected to change. This will result in DNR taking a conservative position regarding future adjustments of the total quota for this species.

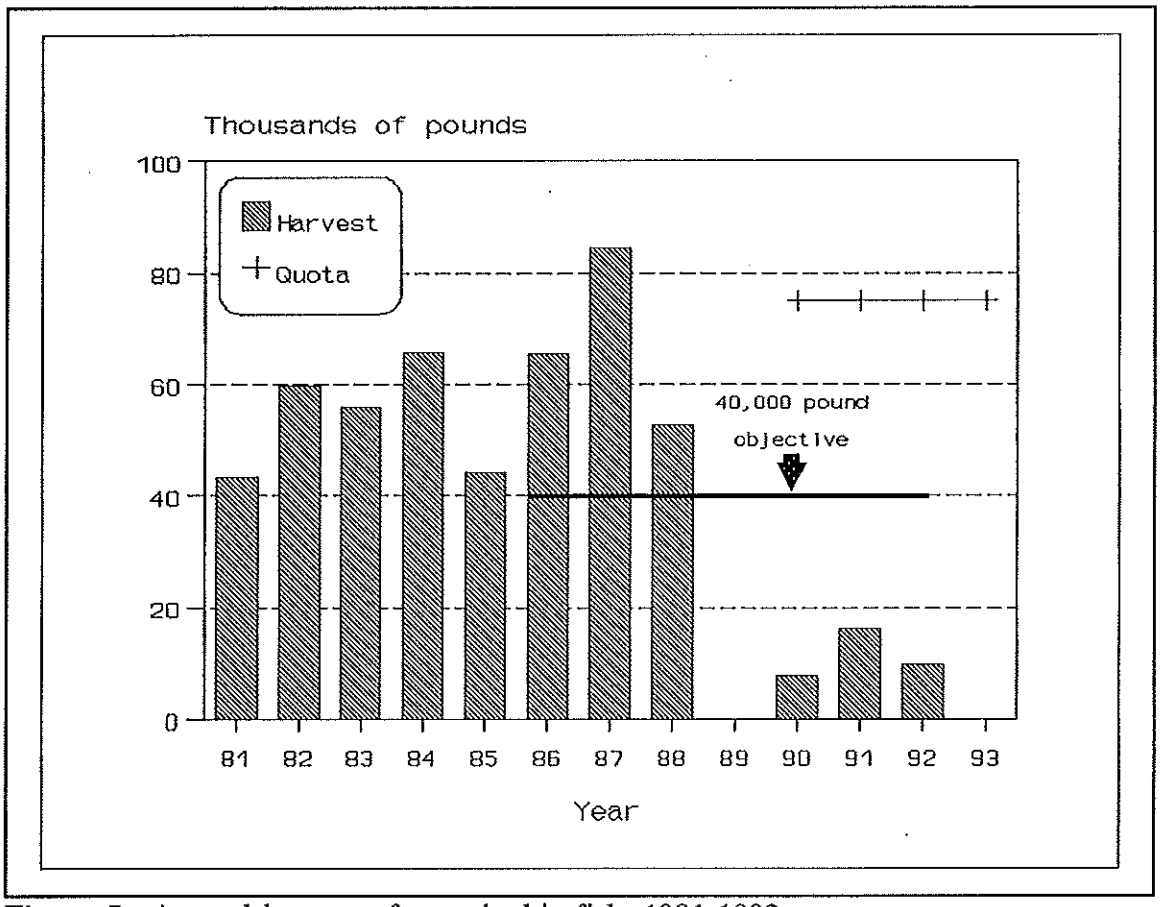

Figure 5. Annual harvest of round whitefish, 1981-1992.

Objective A.5: Determine the status and trends of the Lake Michigan forage populations including, but not limited to, alewife and smelt. Limit trawl units to the number that is currently fishing these stocks until the effects of this gear are better understood.

Reviewed by Paul Peeters

Rationale (from the 1986 Plan):

Population Trends

Forage fish are those species of fish that consistently are eaten by larger fish. These species collectively make up the forage base. Before the 1900's the forage base consisted primarily of chubs, herring, and emerald shiners. Today, the bulk of the forage base consists of chub, smelt, and alewives. Sculpin, stickleback, suckers, troutperch, herring, shiners, and smaller yellow perch are also eaten, but in significantly lesser quantities. Smelt and alewife are exotic species that have inhabited Lake Michigan since the early 1900's.

In the past, gains made by any one of the forage fish populations have apparently been at the expense of one or more of the other forage fish populations. Since two of the currently dominant forage species (alewife and smelt) are exotic to the lake system, periodic and often dramatic shifts in the various population levels should be expected. As forage fish population levels vacillate, predator diets -- and perhaps growth rates -- should likewise be expected to reflect these changes. Lake Michigan's forage base is of special concern because many of the predators utilizing the forage base are stocked. Over 6.5 million salmonids are annually planted in Lake Michigan's Wisconsin waters alone. Michigan, Indiana, and Illinois also stock salmonids in Lake Michigan. More important than the standing stock of any one of the forage populations at a given point in time is the status of the forage base in general. Of equal importance is the ability of the various salmonid predators to adjust to the shifting forage base.

Currently, lakewide forage fish populations are estimated from fall assessment trawling conducted by the U.S. Fish and Wildlife Service at eight stations on Lake Michigan. From the assessment trawling, estimates of fall standing stocks available to bottom trawls are calculated for chubs, alewives, smelt, and sculpins. Estimated fall standing stocks of alewives (adult and young of the year) available to bottom trawls from 1973 to 1983 have ranged from a high of 123,000 metric tons in 1974 to a low of 29,500 metric tons in 1983. During the same time period, the estimated fall standing stock of smelt (adult and young of the year) available to bottom trawls has ranged from a high of 32,770 metric tons in 1982 to a low of 11,070 metric tons in 1976. The chub population has continued to build from the lowest levels, which were observed in 1977. Adult chubs (yearlings and older) were 328 times more abundant in the 1983 trawl survey than they were in 1977.

Harvest and Utilization

The harvest of alewives from the Wisconsin waters of Lake Michigan from 1974-1983 has ranged from a high of 43,823,000 pounds in 1977 to a low of 12,892,000 pounds in 1980, with a 10-year average of 28,402,000. During the past 10 years, pound nets and trawls have accounted for all of the alewife harvest. During the past five years, trawls have accounted for 96.4 percent of the harvest. More than 99.5 percent of the alewife harvests over the past 10 years was taken from statistical districts WM1, WM3, and WM5, with WM4 accounting for more than 60 percent (see Figure 8).

Alewives are harvested primarily for the pet food/fish meal industry, and yearly harvests reflect marketability more than they indicate population levels. The harvest can be separated into two distinct fisheries: deepwater and shallow-water. These distinctions are based on water depth, time of year, and incidental catches.

Analysis

Trawlers have operated on Lake Michigan since the late 1950's. Since the 1960's, trawlers have been used extensively for the harvest of alewife and, as of late, smelt. There is speculation as to how trawling affects target species populations and/or incidental species populations, but little documented evidence. Until now, the trawl fisheries: smelt, deepwater alewife, and shallow-water alewife.

Overview of progress through 1992:

There has been an extensive multi state and federal agency effort to determine the status and trends of the Lake Michigan forage base.

Since 1986 there have been several commercial trawl rule change initiatives. Collectively, these trawl rule changes have effectively prevented the expansion of the commercial trawl fishery (number of trawl units and area in which trawls fish), and placed a cap on the total commercial trawl harvest. Additionally, the new rules have redirected the commercial trawl harvest from a high volume, low value, animal food fishery to a high value human food fishery.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Inadequate information exists to determine the status and trends of the forage base.

Tactic: Continue the trawler monitoring to determine the impact on target and nontarget species.

Trawl monitoring continued throughout the period from 1986 until present. Trawl monitoring did characterize the impact of the trawl industry on the target and non-target species of fish. This monitoring had to be continually adapted to adequately meet the

needs of a changing trawl fishery.

Tactic: Develop techniques to use trawl monitoring data as an index of changes in the forage base.

Trawl monitoring data was not developed into indexing techniques as envisioned. Other, more promising techniques such as hydro-acoustic sampling were developed. Although specific techniques to use trawl monitoring data as an index of changes in the forage base were not developed, much of the information gained as a result of the commercial trawl monitoring project added important insight to our understanding of the Lake Michigan forage populations.

Tactic: Work with U.S. Fish and Wildlife Service, Sea Grant, and other agencies working on forage base to better characterize lakewide population status.

Since 1986 there has been an extensive amount of inter agency cooperation in the development of new forage base evaluations. As a result of this multi-agency development in which Wisconsin played a major role, forage base populations are currently estimated by the U.S. Fish and Wildlife Service, with the use of hydro-acoustics in addition to the fall bottom trawl surveys that have been done for the last several decades. The WDNR has also cooperated with other agencies in other forage base related projects such as the smelt project currently being conducted by U. W. Stevens Point.

PROBLEM 2: An expanded trawl fishery could negatively impact the forage base and nontarget species.

Tactic: Limit trawl units in Wisconsin waters of Lake Michigan to the number currently fishing.

In 1986, trawl units were limited to the number of trawl units actively engaged in trawl fishing.

Tactic: Restrict trawling to those areas of Lake Michigan and Green Bay that have been trawled within the last 5 years.

In 1986, trawling was restricted to the waters of southern Green Bay and all or part of eight grids in the waters of Lake Michigan deeper than 60 feet. In 1988, commercial smelt trawls operating in southern Green Bay were restricted to waters deeper than 65 feet.

PROBLEM 3: The current forage base consists largely of exotic species with unstable population characteristics.

Tactic: Explore the reintroduction of native forage species, such as herring, emerald shiners, and other species of chubs.

Other than the attempted reintroduction of lake herring some years ago, no other native forage species have been reintroduced. However, over the last decade as the alewife population has declined, there have been slight but noticeable increases in some of the other native forage species that were not extirpated from Lake Michigan, i.e. emerald shiners, and spottail shiners. The gizzard shad (originally native to the Mississippi drainage and introduced to the Lake Michigan drainage) has also become more abundant.

Issues of concern in 1992:

Since 1986 there have been and continue to be dramatic shifts in the Lake Michigan forage base fish populations. Alewives no longer dominate the forage base of Lake Michigan. Bloater chubs, the one remaining native cisco (at critically low levels in the 1970's) has made a dramatic comeback and is once again an important part of the Lake Michigan forage base. Concern for the current forage base of Lake Michigan gave rise to an intensive salmonid diet study of Lake Michigan salmonids. Additional exotic species have made their way into the great lakes. These include: ruffe, three spine stickleback, white perch, gobies, b.c. (Bythotrephes cederstroemi), and zebra mussel.

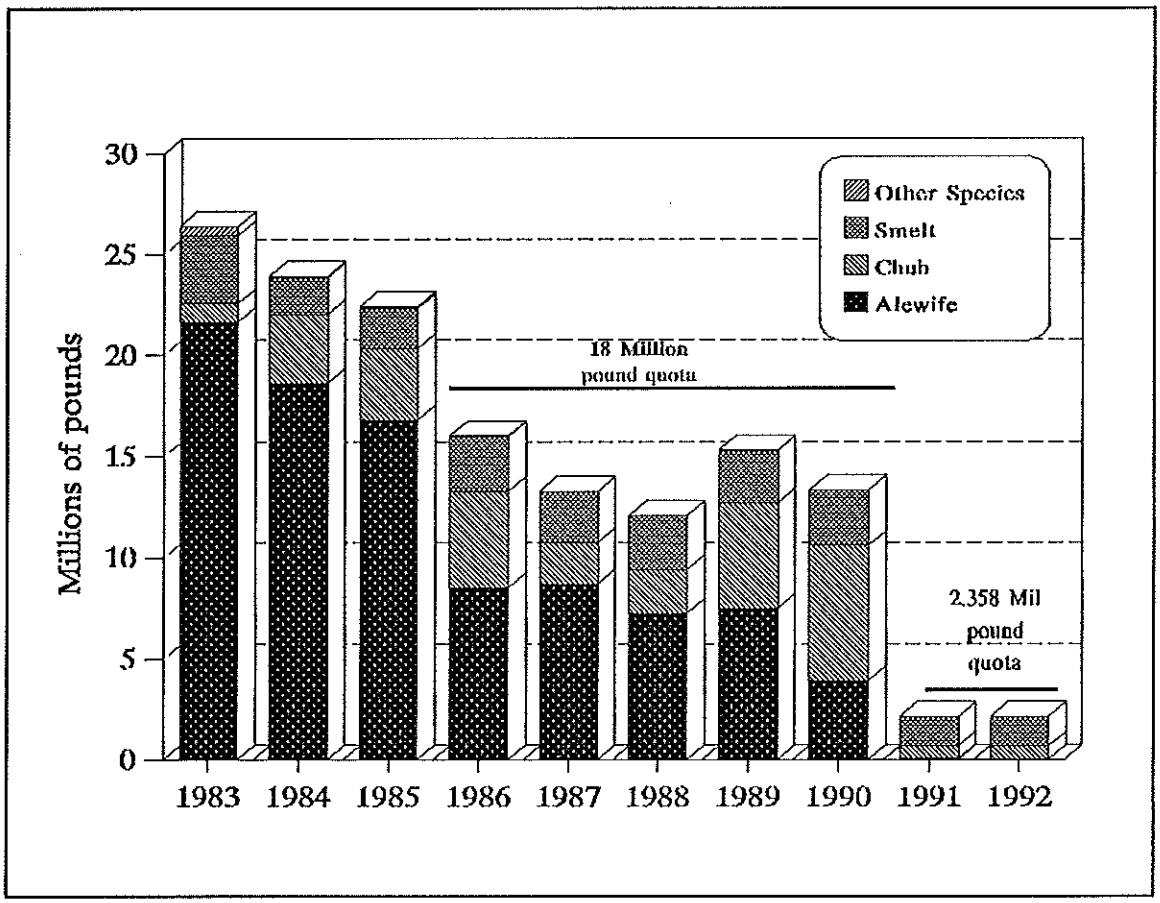

Figure 6. Total forage harvest by trawling for all Wisconsin waters of Lake Michigan, 1983-1992.

Objective A.6: Describe and characterize the Northern Pike population in Green Bay.

Reviewed by Brian Belonger

Rationale (from the 1986 Plan):

From 1944 through 1982, commercial northern pike production in Green Bay averaged 24,670 pounds annually, with a high of 90,000 pounds in 1953 and lows of 6,000 pounds in 1959 and 1982. Since 1967, there has been a trend of declining harvests, possibly due to lower abundance caused by habitat loss (less emergent vegetation), since current exploitation rates appear to be relatively low.

Approximately 40 percent of the 1981 northern pike harvest was incidental to the perch fishery. This species has a relatively low market value, with a 1981 dock-side total value of approximately $1,500 for the 13 fishermen who reported landing northern pike.

Overview of progress through 1992:

Northern pike are a native top predator in the Green Bay fish community and are recognized in the Fox River/Green Bay Remedial Action Plan as important for developing a balanced, more stable fish community. Beginning in 1989, northern pike were allocated entirely to the sport fishery. The creel survey estimate of sport harvest for ice and open water combined has averaged 6,371 fish annually since 1986.

Without a specific project, northern pike have been tagged and biological information collected during sampling for the Fox River and Green Bay Remedial Action Plan, during monitoring of commercial sucker nets in the Pensaukee and Oconto Rivers, and during spring walleye spawning assessment at Sturgeon Bay. Age, growth and movement information is being collected. A pilot project has been funded to evaluate a spawning marsh enhancement on west shore ditches. Initial indications are that the ditches are important for northern pike reproduction.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Inadequate resource base information limits management effectiveness.

Tactic: Develop surveys to assess angler pressure, harvest, population characteristics and relative abundance.

Since 1986 the Great Lakes creel survey has provided estimates of northern pike harvest and angler pressure. A survey technique has not been developed to provide a good estimate of relative abundance or adequately characterize the Green Bay population. Traditionally northern pike population estimates are based on sampling spawning sites. Because of the large number of potential sites and movement of fish between sites it

would be extremely expensive to make a periodic population estimate or even develop an annual relative abundance estimate. We cannot provide this with our current level of sampling. It would require a major effort and substantial cost. Base line information has been collected on several river spawning populations.

Tactic: Inventory remaining spawning habitat, measure quality and monitor trends.

This work along with spawning habitat enhancement was started in 1991. A crude estimate of fingerling northern pike production on one west shore ditch was 56,613 indicating the importance of these areas. EPA funding is being pursued to expand the scope of this project.

Issues of concern in 1992:

Some sport fishermen are concerned that northern pike adversely affect yellow perch.

Northern pike are extremely vulnerable to illegal harvest in Green Bay ditches and small tributary streams during the spawning season.

Objective A.7: Encourage the development of a fishery in Lake Michigan and Green Bay to harvest burbot, carp, suckers and other under-utilized species.

Reviewed by Brian Belonger

Rationale (from the 1986 Plan):

The burbot population appears to be on the rise. Since 1944, commercial burbot landings have averaged 36,600 pounds annually, with a high of 166,000 pounds in 1977, and a low of less than 1,000 pounds in 1962. In the past three years, landings have increased from 28,500 to 36,500 to 74,500 pounds, and probably will jump again in 1983.

Abundant burbot populations may impact negatively on other high value commercial and sport species. Because of the low value of burbot, exploitation of the population is limited at the present time.

Carp and suckers are also abundant and may be competing with more desirable species for food and space. With an improvement in the market, these fisheries could provide additional income to the commercial community.

Should fisheries for under utilized species expand, great care must be taken to insure that the methods of harvest and the gear used do not contribute to excessive mortality of nontarget species.

Overview of progress through 1992:

In 1989 rules were put into effect(FM-40-88) to protect fish stocks, reduce incidental catch, implement limited entry and enhance the viability of the remaining fishery. These rules resulted in major changes in the approach to managing the commercial fishery. All the remaining high value species not yet managed by quota were place under a quota system. As a result, to prevent the waste of quota species caught in nets set for low value species not protected by quota a contract system was developed for harvesting low value species. Incidental contracts allow fishers to take low value species in nets set for quota species up to a weight equal to their quota species. Targeted contracts will allow fishers to harvest low value species under a set of criteria yet to be developed but related to protection of non-target species and protection of human health.

In 1991, the reported commercial catch of low value species was 66,073 pounds of suckers, 22,404 pounds of burbot, 6,972 pounds of sheepshead, 5,465 pounds of bullhead, 3,592 pounds of white bass and 3 pounds of white perch. A one million pound contract for harvesting carp for their skins was worked on in 1992 after guarantees were obtained that the flesh would not reach the human food market. However, in the final analysis the harvest does not appear to be economically feasible.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Markets for most under-utilized species are lacking, poorly developed, or limited by contaminant levels in the fish.

Tactic: Encourage development and use of new fish products using under-utilized species.

This tactic has been addressed through working out a system to allow the harvest of carp for their skins. Also, the Department has provided fish flesh for the development of methods of composting fish which may lead to a market for under-utilized species.

Tactic: Promote the harvest of under-utilized species.

Harvest of under-utilized species has been accommodated through an incidental contract system which allows the harvest of non-quota species equal to the quota poundage.

An additional contract for suckers running from Green Bay has been issued on the Oconto River and a contract for suckers on the Peshtigo River has been encouraged.

Tactic: Develop and implement incentives for harvest.

There has been no action on this tactic. Other agencies should be encouraged to develop and implement incentives for harvest. Economic development is not part of the Department of Natural Resources' function. The Department's role is to insure that procedures are ecologically sound.

PROBLEM 2: Inadequate resource data base limits management effectiveness.

Tactic: Develop surveys to assess pressure, harvest, and population characteristics.

At the request of, and with assistance from the Department of Natural Resources, a burbot population dynamics and food habit study was conducted by the Fishery Cooperative Fishery Unit at the University of Wisconsin-Stevens Point.

The commercial harvest continues to be tracked through the bi-weekly commercial catch reports at Sturgeon Bay.

Issues of concern in 1992:

Additional gear set for low value species will produce varying degrees of non-target mortality an interfere with sport fishing.

High contaminant levels in carp from Green Bay limit their market potential.

Objective A.8: Develop and implement management tactics to minimize or eliminate incidental catch mortality of all nontarget species.

Reviewed by George Boronow

Rationale (from the 1986 Plan):

The incidental catch of nontarget species is one of the most serious problems confronting a multiple-use fishery such as that on Lake Michigan and Green Bay. This problem poses a real threat to both sport and commercial fishing objectives because it places them in conflict.

Every effort must be made to seek methods to reduce the impact of one fishery upon another. This is most difficult where species coexist in close proximity such as occurs with whitefish and lake trout, and with perch and walleye.

In some instances the information needed to better manage a fishery simply does not exist and additional investigations are required. In other cases, the information exists, but traditional commercial fishing methods are difficult to change. It is clear that incidental catch will remain an important issue as competition between user groups escalates. This eighth objective--to minimize or eliminate incidental catch mortality--is an integral part of each of the previous commercial fishing objectives.

Overview of progress through 1992:

Incidental catch of nontarget species is always a concern in the commercial fishery. Some level will always occur, but management actions are designed to keep incidental catch at low acceptable levels. The quota controlled fishery implemented for the major species helped to minimize incidental catch. When the target species populations are abundant and healthy, the fishery is most efficient. With high catch rates, fishing effort will decline, reducing the overall incidental catch.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Additional information is needed to determine the incidental catch by each fishery.

Tactic: Identify specific problem areas and increase monitoring to improve information base.

1) Walleye in the Green Bay yellow perch fishery - This was investigated from 1984 through 1987 and found to be at an acceptable level at this time. The yellow perch quota contributed to an increased yellow perch population which improved the commercial fishery catch per unit effort. Therefore, less net was set to catch the quota, keeping the walleye incidental catch at an acceptable level.

2) Lake trout in whitefish gill net fishery - The institution of the allocated whitefish quota in 1989 resulted in a shift to a greater percent of the fishing effort to trap nets. Much of the previous effort was from smaller gill net operators who needed to fish less net to catch their quota and some of whom sold their quota to the trap net operators. The gill net effort declined substantially resulting in a substantial decline in dead lake trout. In trap nets, where is a high incidental catch of lake trout, but immediate mortality is low as most of these fish are released alive.

3) Chinook in the Lake Michigan yellow perch fishery - The opening date of the season was moved back to September 15 to prohibit fishing when monitoring identified a period of high incidental catch of chinook.

4) Lake trout in the small mesh chub and yellow perch fishery - Low profile gill nets were required to reduce incidental catch with minimal impact on the targeted catch.

5) Incidental catch in the trawl fishery - Monitoring determined which species were a problem. Incidental catch of lake trout in Lake Michigan and whitefish and yellow perch catch in Green Bay was high. Other trout and salmon were not encountered at high levels. Rules were changed to require diverters to reduce incidental catch. Chubs are a high incidental catch, especially in the Lake Michigan trawling. To reduce alewife incidental catch, trawling was restricted to November 15 through April 20 in Lake Michigan and to hours of darkness on Green Bay, when most alewife move off the bottom and few are captured.

PROBLEM 2: Harvest objectives may be unattainable if incidental catch problems cannot be resolved.

Tactic: Determine the acceptable levels of incidental catch for each commercial fishery.

An acceptable level of incidental catch was developed for lake trout. A population simulation model was developed in 1983 based on projected stocking levels and a 40% total mortality level. The acceptable harvest level for the commercial and sport fishery combined was estimated at 129,000 lake trout.

Extensive monitoring was conducted through the 1989-90 commercial license season with some monitoring through the 1990-91 season. Budget limitations drastically reduced monitoring since July 1991. Without current monitoring, problem areas and changes in the fishery cannot be identified or evaluated.

Tactic: Investigate and encourage alternative methods and gear modifications to minimize incidental catch.

The move to quota control brought changes which reduce some incidental catch. One

example is in the whitefish fishery, which shifted from high gill net effort to more trap nets with less mortality. Examples of gear modifications include diverters in trawls and release openings in trap nets to release incidental catch without handling the fish.

PROBLEM 3: Traditional methods of commercial fishing are difficult to change.

Tactic: Provide commercial fishers with incentives to use alternative harvest techniques.

The commercial fishery does not want a high incidental catch, which often can physically interfere with their operations. Also, they do not want to create conflicts with the sport fishery or other segments of the commercial fishery. This desire has been an incentive in some cases. The trawl fishery developed diverters for use in Green Bay, especially to reduce the incidental catch of yellow perch.

Issues of concern in 1992:

Projects to conduct monitoring have been submitted for approval, but were not funded. Now little or no monitoring is being conducted because of the difficulty to find a logical funding source. Funds received from commercial fishing license sales are insufficient to fund existing projects to administer licensing, catch reporting, quota calculations, and commercial species population assessments. There already is an inordinate portion of sport fishing license money spent on the commercial fishing programs.

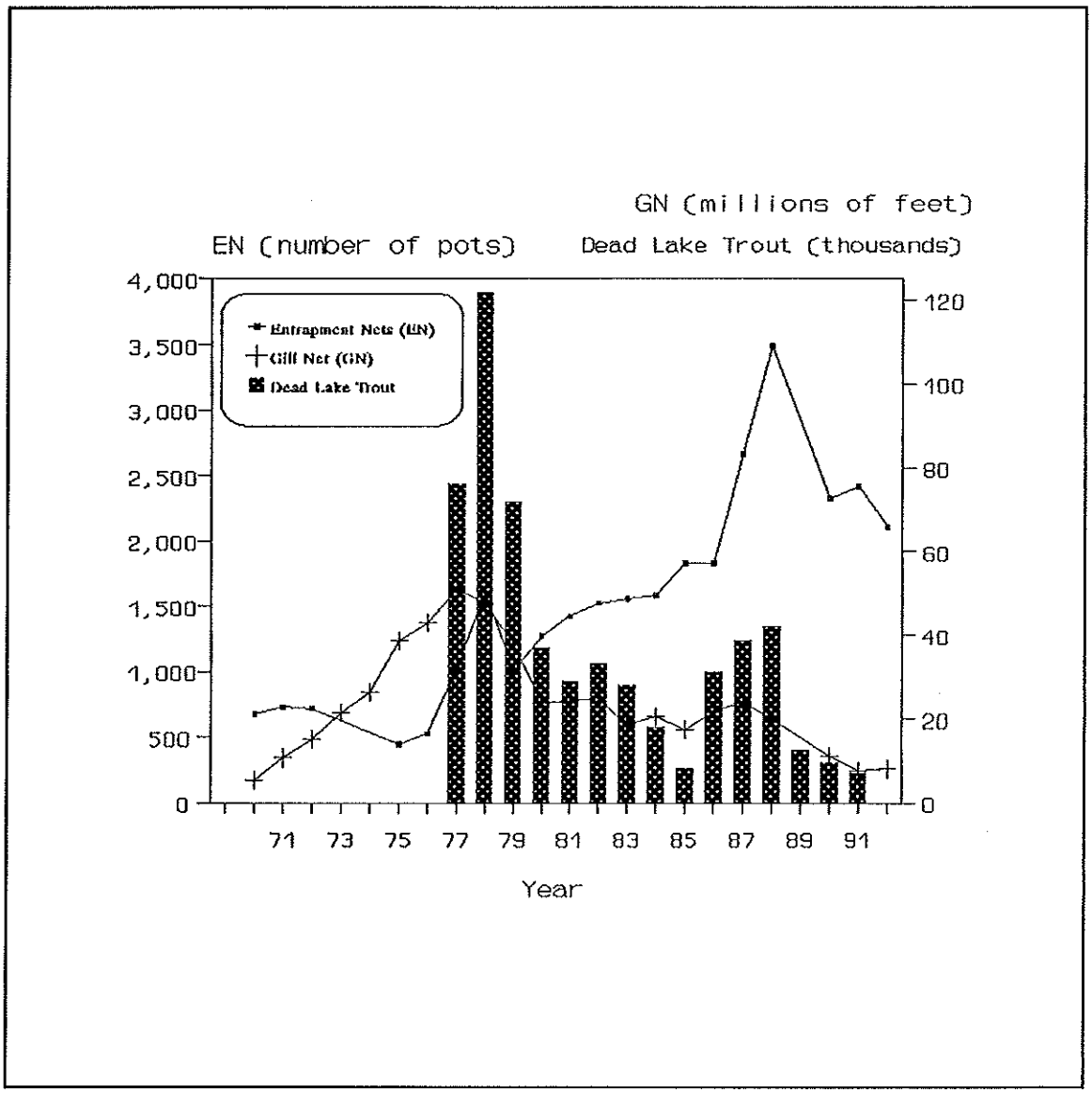

Figure 7. Annual incidental kill of lake trout in gill nets and trap nets, 1977-1991. Annual fishing effort in trap netting (number of pots, EN) and gill netting (millions of feet, GN) are also shown.

Objective B.1: Maintain the 1982-1984 average annual harvest of 650,000 trout and salmon within the capacity of the forage base.

Rationale (from the 1986 Plan):

The major objective--to manage for an annual harvest of 650,000 fish--is designed to maintain the 1982-1984 average annual harvest. This objective was deemed most important due to recent concerns about the health of the alewife population. Evidence from the Fish and Wildlife Service suggests that the alewife population has been declining in the last few years. Expanding stocking and harvest of game fish may jeopardize the current status of alewives. Substantial declines in the alewife population could affect the future of the Lake Michigan fishery.

Overview of progress through 1992:

See discussions of subobjectives, below.

Subobjective B.1a: Reduce lake trout harvest to 82,000 fish or less and reduce harvest in streams to zero.

Reviewed by Mark E. Holey

Rationale (from the 1986 Plan):

The first subobjective is to reduce the lake trout harvest to 82,000 fish a year--a prerequisite to achieving lake trout rehabilitation in Lake Michigan. The lake trout sport harvest from 1981 to 1983 averaged 137,000 fish. The 82,000 annual limit is based on a 40-percent reduction of that catch level, and on expected availability of federal fish. Forty-percent reductions in incidental mortality by the commercial fishery will also be necessary to achieve rehabilitation.

Overview of progress through 1992:

The annual sport harvest of lake trout has failed to meet the 82,000 fish or less goal every year since 1986 except 1990 when the harvest was 75,177. From 1986 to 1991 the sport harvest of lake trout averaged 92,093 fish with a maximum of 113,930 in 1987. Through changed stocking practices and revised fishing regulations the stream harvest of lake trout has been eliminated.

The 82,000 harvest target for trout was determined from a simulation model developed in 1983 and was based on projected stocking levels and a 40% total annual mortality target. Lake trout stocking priorities have changed since 1993. The target harvest level should be re-estimated based on the most recent stocking, mortality and fishing effort data.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Too many lake trout are removed by an increasingly popular sport fishery.

Tactic: Reduce sport harvest of lake trout (see lake trout objectives).

In 1986 the Department changed the continuous open season on lake trout to a May 1 to labor season, lowered the daily bag limit from five to two, and created a refuge between Sturgeon Bay and Algoma that was closed to lake trout sport fishing. A 402 square mile refuge was created on the midlake reef area to protect the lake trout stocked there. The Midlake Refuge prohibits all fishing (sport and commercial) of any kind.

PROBLEM 2: Too many lake trout are entering streams to spawn where success is unlikely.

Tactic: Prohibit lake trout stocking in or near tributary streams.

Since 1985 all lake trout have been stocked by boat over traditional spawning reefs.

Issues of concern in 1992:

With the decline in the harvest of chinook salmon the fishing pressure on lake trout is likely to increase. The stocking goals for lake trout have frequently not been met, which may require even fewer than 82,000 lake trout to be harvested to maintain the 40% mortality rate goal. Another problem is that in some areas of the lake the mortality goal has not been reached, which again would require a reduced harvest goal.

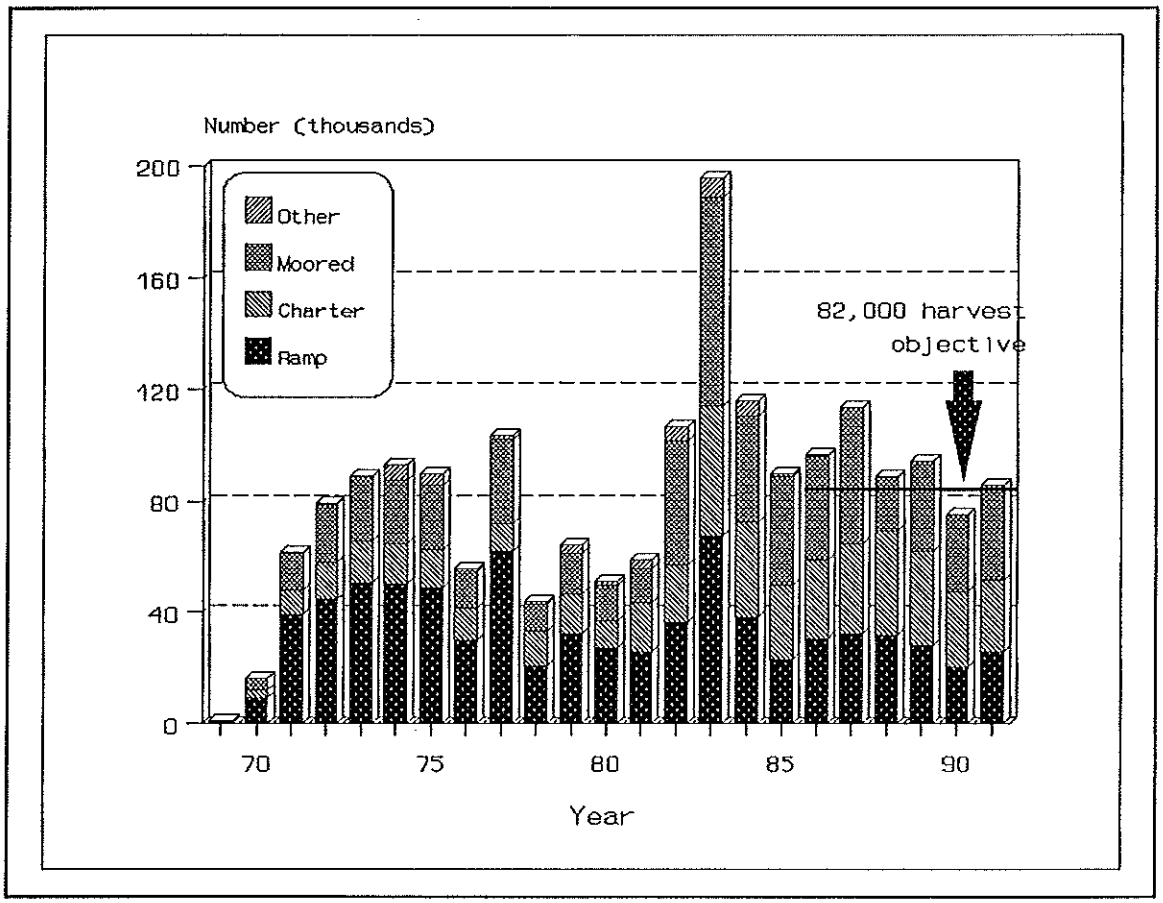

Figure 8. Annual sport harvest of lake trout in Wisconsin waters of Lake Michigan, 1969-1991.

Subobjective B.1b: Increase rainbow trout harvest from 25,000 to 50,000 annually.

Reviewed by Mike Coshun

Rationale (from the 1986 Plan):

A second subobjective is to increase the rainbow trout harvest in Lake Michigan. Based on creel census data, rainbow trout harvest has been declining while stocking has increased. This problem may be due to a shift in rainbow trout strains that are currently stocked. There is some evidence that the rainbow trout that are stocked do not home to tributary streams at spawning time. Since the fishery in the past has yielded greater numbers of rainbow trout, the objective might be achieved by planting different strains that have stronger homing characteristics. The increase in rainbow trout harvest will partially offset the reduction in lake trout harvest.

Overview of progress through 1992:

Annual sport harvest of rainbow trout in the Wisconsin waters of Lake Michigan exceeded 50,000 fish each year since 1987. Especially dramatic increases have occurred in the stream fishery component of this harvest. Stream harvest of steelhead has tripled since 1985 and steelhead fishing is now available from August through mid-May. The trolling fishery accounted for the majority of the steelhead harvest since 1986. Like the stream fishery, trolling for steelhead has been nothing short of fantastic. Since 1987 trollers have harvested an average of approximately 50,000 steelhead per year. This fishery has fast become the most popular open-water fishery in Wisconsin's Lake Michigan program.

This objective provided the impetus for formation of a steelhead management committee consisting of Lake Michigan fisheries biologists and hatchery managers. The committee identified impediments to reaching objectives for steelhead management and developed tactics to overcome these problems. The committee process led to the development of a Lake Michigan Steelhead Fishery Management Plan published in 1988 (Administrative Report No. 29).

The rationale for steelhead in the 1986 Lake Michigan Fisheries Management Plan is in need of updating. I recommend using the Steelhead Plan and recent protocol developed by the Steelhead Committee in the future rationale statement. Additionally, our steelhead fishery has gained tremendous popularity in recent years. We may need to revisit our annual catch objective for this species.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Return to creel has declined despite steady increase in number of rainbows stocked.

Tactic: Stock and assess various strains of rainbow trout to maximize catch/stock ratio.

We are presently managing three strains of steelhead: Skamania, Chambers Creek, and Ganaraska. This mixture has vastly improved stream fishing opportunities and lengthened the time period through which these fish are available to stream anglers. Total harvest of steelhead has averaged approximately 65,000 fish per year from 1987-91.

Tactic: Increase the number of stocked yearling rainbows and decrease the use of small fingerlings.

Our current Lake Michigan Steelhead Fishery Management Plan (Administrative Report No. 29) recommends stocking only yearling steelhead. The vast majority of steelhead stocked since 1986 have been yearlings.

Issues of concern in 1992:

We need to consider the needs of three angling groups served by this fishery: boat anglers, shore anglers and stream anglers. Michigan has experienced considerable conflict between their stream and boat anglers over the allocation of steelhead harvest.

We need to continue to stock strains that offer diverse opportunities for steelhead fishing. Steelhead harvest by various components of the fishery needs to be closely monitored. Specific regulations for each component may be needed if harvest patterns by a particular fishery component become problematic.

Our greatest problem may be meeting the demand for steelhead fishing created by the success of our program in Wisconsin. We need to consider the agencies capacity to produce yearlings for stocking. The carrying capacity of the forage base for steelhead needs to be better understood. Some important decisions about angler preference and species mix in our program need careful consideration.

Subobjective B.1c: Increase the harvest of the remaining salmonid species to compensate for lake trout harvest reductions.

Reviewed by Brad Eggold

Rationale (from the 1986 Plan):

The third subobjective is intended to offset the reduced lake trout harvest to maintain the 1982 catch level. This will be accomplished by continued investigation and use of new or modified strains of salmonids that should provide a greater return to the creel than those currently stocked. Examples are Nipigon brook trout, Skamania rainbow, wild/domestic crosses of brown trout and earlier-returning coho salmon. It also includes refining and upgrading stocking techniques such as increased use of yearling salmonids which have a higher survival rate.

Overview of progress through 1992:

The major objective of the sport fishery goals is to maintain the 82-84 average annual harvest of 650,000 trout and salmon within the capacity of the forage base. The annual harvest peaked in 1987 at 762,115 fish but steadily declined each year until it bottomed out in 1990 at 353,553. The harvest increased slightly in 1991 to 397,816. This suggests that the objective was not met, yet the available forage base present during these years may have limited the survival of salmon thus decreasing the population and fish available for harvest.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Predation by stocked salmonids lakewide may exceed the capacity of the forage base to sustain predators.

Tactic: Link stocking levels to available forage and obtain agreement with other agencies regarding stocking numbers.

In 1986, Wisconsin Department of Natural Resources reduced chinook salmon stocking by 10% from 2,740,000 to 2,378,000 fish in response to the lower alewife populations. In 1991, WDNR further reduced chinook salmon stocking by 27% from 2,379,000 to 1,740,000 fish. In 1992, Wisconsin, Illinois and Indiana agreed to reduce stocking by 25% from current levels, except that Wisconsin cut stocking based on 1990 levels. Michigan did not reduce stocking of chinook salmon in 1991 or 1992.

PROBLEM 2: Existing hatchery facilities may limit our ability to produce alternative species.

Tactic: Decrease propagation and stocking of species with low return rates.

Several species with low return rates were dropped from stocking including the Shasta strain of rainbow trout.

Tactic: Expand existing hatcheries or purchase new facilities.

No new hatcheries were purchased but several of the existing hatcheries were modified or updated. Brood ponds were purchased at the Kettle Moraine Springs Hatchery. Artisan wells were dug for Westfield and Nevin hatcheries. Bois Brule shaded some of their raceways and added automatic feeders and Bayfield updated some raceways for steelhead. The Kewaunee facility was built in 1990 to take eggs from steelhead, coho and chinook while the Root River facility scheduled for completion in 1993 will collect steelhead and coho eggs.

PROBLEM 3: Sufficient numbers of alternate species or strains may not be available from other sources.

Tactic: Develop our own spawn-taking capabilities and/or brood stocks.

In order to insure that Wisconsin was able to obtain sufficient numbers of alternate species or strains, the WDNR built spawn-taking facilities and brood stock ponds. The Kewaunee facility was built in 1990 and takes eggs from steelhead, coho and chinook. In addition, the Root River facility will be developed to take additional eggs from steelhead and coho. In years when the Kewaunee facility did not get enough eggs, the Root River was used to collect brood stock for spawning and transferred to the KMSH.

PROBLEM 4: Additional data on stocking is needed to provide direction to stocking policies.

Tactic: Evaluate different strains of salmonids that will provide an improved rate of return.

Several strains of salmonids are being evaluated including the Seeforellen brown trout, New York chinook and coho salmon and lake trout strains. The three strains of steelhead (i.e. Skamania, Ganaraska and Chambers Creek) currently stocked in Wisconsin waters were evaluated and the return rate increased from 6.5 fish/1,000 hours in 1985 to 18.8 fish/1,000 hours in 1991. Splake were also evaluated and found to contribute to both the spring ice fishery and spring open water fishery in Green Bay.

Tactic: Evaluate different stocking techniques and locations to maximize returns.

A study comparing stocking methods (release from a rearing pond vs. river vs. lake) was started in 1986 to determine which method had the greatest survival of stocked fingerling chinook salmon. The relative survival rate was greatest for pond released fish, followed closely by river released, then lake released fish. No other differential stocking

techniques have been used to increase survival, although several projects have been proposed but have not been funded. Stocking location evaluation has led to the stocking of coho salmon and steelhead in rivers to eliminate predation by seagulls, improve imprinting and increase survival of these species. In addition, accelerated growth coho salmon have been stocked since 1989.

Issues of concern in 1992:

Current results suggest that the alewife population declined in the early 80's and has remained low. The need for strains of salmonids with better return rates is very important. The strain evaluations currently being investigated, including the Seeforellen brown trout, Nipigon brook trout, New York chinook and coho salmon, steelhead strains and lake trout strains may help to improve the return rates. Reduced stocking of chinook salmon by Wisconsin, Illinois and Indiana may help offset the low alewife population and actually provide better return rates for all salmonids. The annual harvest of 650,000 trout and salmon may be to high based on current forage populations but the rationale to maximize the harvest is still valid.

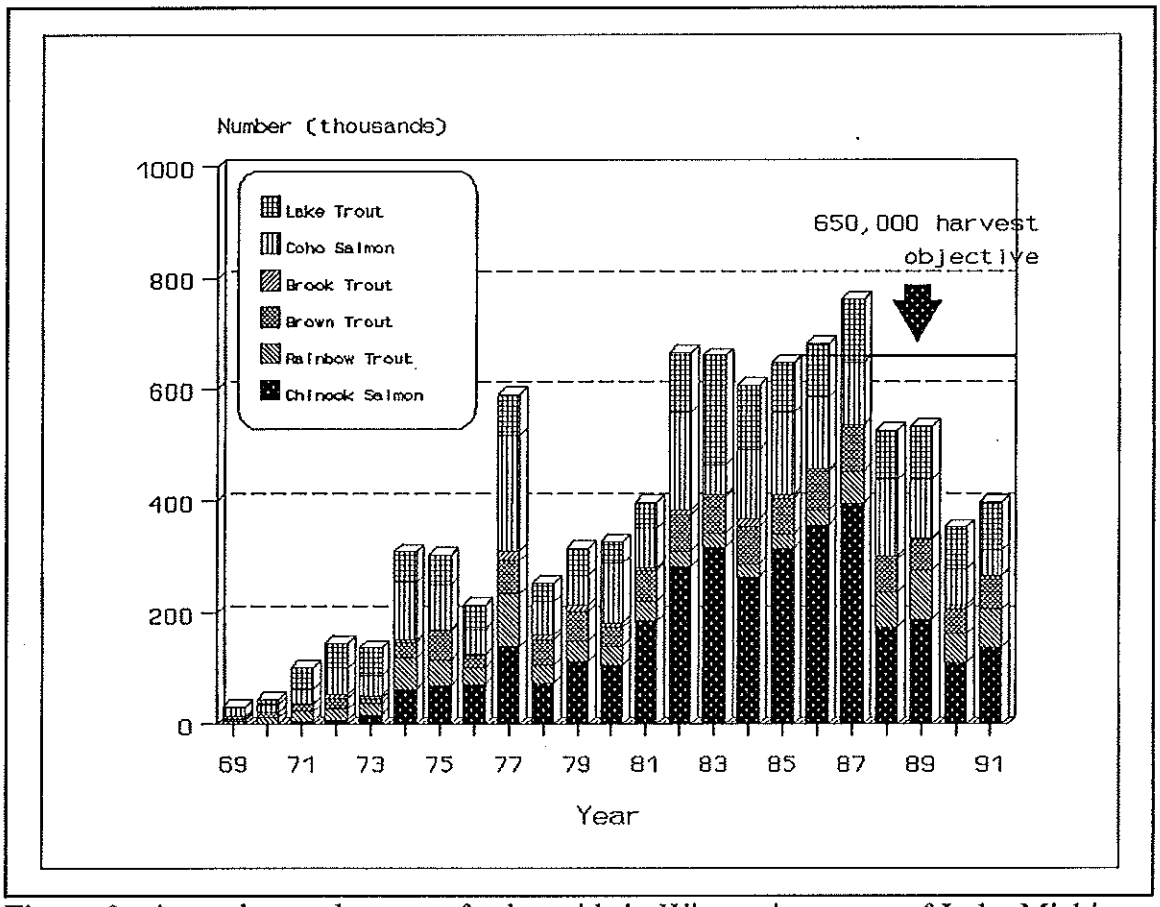

Figure 9. Annual sport harvest of salmonids in Wisconsin waters of Lake Michigan, 1969-1991.

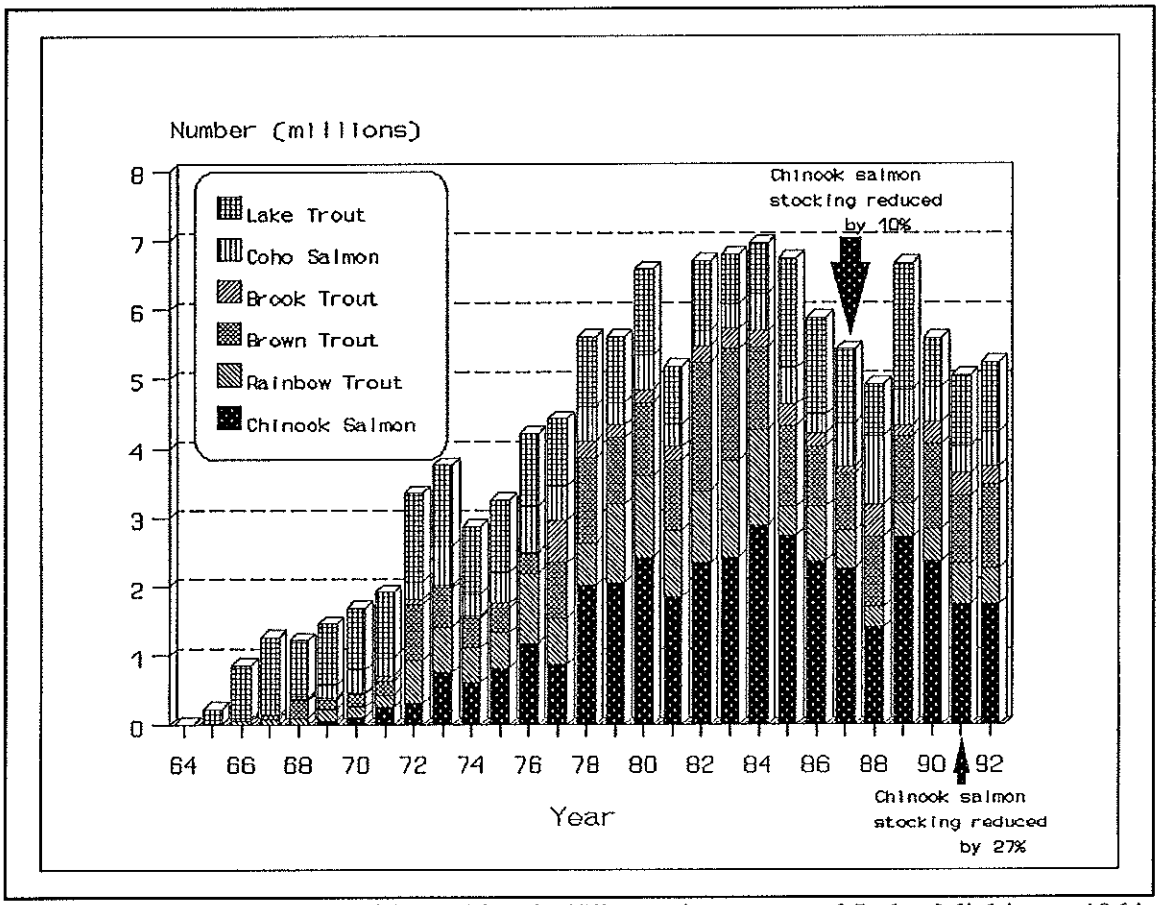

Figure 10. Annual salmonid stocking in Wisconsin waters of Lake Michigan, 1964-1992.

Subobjective B.1d: Produce a limited trophy fishery for chinook salmon that exceed 50 pounds.

Reviewed by Mike Toneys

Rationale (from the 1986 Plan):

The final subobjective is to produce a limited trophy fishery for chinook salmon that exceed 50 pounds. Satisfaction in a sport fishery partly depends on having a wide size-range available. The rare opportunity to catch an unusually large fish is an important aspect of any sport fishery. Recent techniques in the sterilization of salmonids may provide the management opportunity to develop a greater diversity in size of chinook salmon. The sterilization of chinooks may cause the fish to defer maturity indefinitely and to continue to grow several years beyond their normal life cycle.

Overview of progress through 1992:

The objective of producing a trophy fishery for 50 pound chinook has not been achieved. Although an increasing number of 30 pound + fish have been caught in recent years, none have exceeded the current state record of 43 pounds set in 1983. Not enough time has elapsed to determine if the sterilized fish released will reach 50 pounds since the first of three year classes was stocked only six years ago. Through 1991 the largest "sterilized" chinook reported caught was a 3-year old, 26 pound female off Sheboygan.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: The four year life cycle prevents chinook salmon from growing to 50 pounds.

Tactic: Stock limited numbers of sterilized salmon to lengthen their life cycle to produce a larger salmon.

Three year classes of sterilized chinook were stocked at four locations from Marinette to Racine, 1986 - 1988 (a total of about 280,000 fish). Recoveries of those coded wire tagged (CWT) fish have been ongoing since 1987.

Tactic: Stock limited numbers of Alaskan strain (Kenai) chinook.

We did not stock any Kenai strain Alaskan chinook salmon due to the prohibition against importing into Wisconsin any fish not certified disease free.

Issues of concern in 1992:

The sterilization method used (feeding the steroid methyltestosterone) was neither totally

successful nor conducive to good growth. At least some of the "sterilized" fish did in fact mature sexually and growth in general has been slower compared to non-sterilized fish. The BKD epidemic that has been ravaging chinook in the Lake since 1988 may have negatively impacted production of a trophy fishery through decreased survival. On the positive side, survivors with less competition have been growing to larger sizes. The impact of continued low abundance of alewife, the preferred food, is unclear.

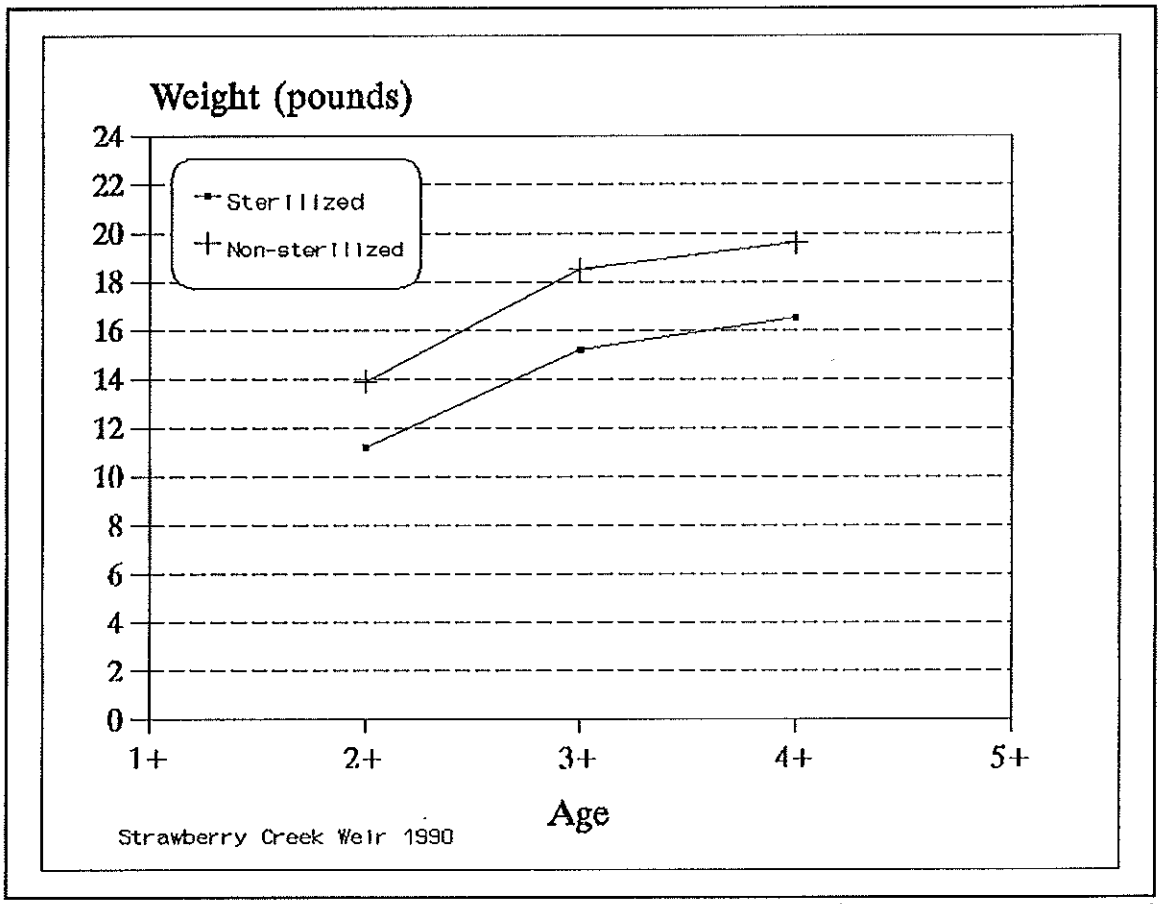

Figure 11. Mean weights of sterilized and non-sterilized chinook salmon captured at the Strawberry Creek Weir in the fall of 1990.

Objective B.2: Manage the redeveloping perch sport fishery in Lake Michigan and Green Bay.

Rationale (from the 1986 Plan):

See discussions of subobjectives, below.

Overview of progress through 1992:

See discussions of subobjectives, below.

Subobjective B.2a: Manage Green Bay for an annual sport harvest of 1.2 to 1.9 million yellow perch that average 4-5 per pound.

Reviewed by Brian Belonger

Rationale (from the 1986 Plan):

At the present time, the sport fishery accounts for approximately 15 percent of the yellow perch harvest from Green Bay. This objective would increase that to 44 percent of the combined harvest. This would be accomplished by limiting the commercial fishery through quota control, which would allow improved abundance and size distribution that in turn would increase sport fishing catch rates and/or participation, and improve the size distribution of the sport harvest.

Overview of progress through 1992:

The yellow perch population in southern Green Bay is shared by sport and commercial fisheries. In the early 1980's the harvest was dominated by the commercial fishery (approximately 85% of the harvest). The Green Bay Perch Management Plan proposed to limit the commercial fishery through quota control, to allow improved abundance and size distribution that in turn would increase sport fishing catch rates and participation. The sport fishery increased beyond expectations primarily due to the development of a highly successful ice fishery. While open water creel survey harvest estimate has increased and varied between 1.1 and 1.9 million perch annually since 1986, the ice harvest estimate has increased and fluctuated dramatically between 25 thousand perch in 1986 and 2.1 million in 1990. Ice and weather conditions play a major role in the accessibility of perch in the winter. In February of 1991 the sport daily bag limit on perch was reduced from 50 to 25 in Green Bay waters to increase protection on the population.

The sub-objective of maintaining an average size of 4 to 5 fish per pound has been met. In 1983, the sport-caught yellow perch averaged 6.5 fish per pound. Since 1986 they have ranged from 3.9 to 5.0 perch per pound. The relative year class strength of various age groups impacts on the year-to-year variability of the average size as well as the growth rate.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: The harvest is inequitably distributed between user groups.

Tactic: Allow expansion of the sport fishery while restricting commercial harvest through a quota to achieve a more equitable harvest between user groups.

The commercial harvest has been restricted by quota and the sport fishery has expanded as described above. The trend has shifted from a harvest dominated by the commercial fishery to one dominated by the sport fishery.

Tactic: Improve creel survey coverage to assess harvest.

Creel survey effort has approximately doubled since 1984. In addition, the creel census was redesigned in 1986 to provide better coverage of cool and warm water species and provide more species specific information. In 1990 the creel census technique of time interval counts was developed to improve coverage of the rapidly developing ice fishery.

PROBLEM 2: The perch population size structure is inadequate to provide the creel with a sufficient number of fish of a desirable size.

Tactic: Maintain a quota-controlled commercial fishery.

The commercial fishery continues to be managed under a quota-controlled system.

Tactic: Assess the impacts of predation and growth rates on the size structure.

Limited food habitat information collected through University studies, The E.P.A. Mass Balance Project, and DNR sampling on walleye and salmonids has not indicated significant predation on yellow perch. Predation on yellow perch by burbot was documented by Thomas Fratt and Richard Bruesewitz in their U.W. Stevens Point study. The U.W. Madison is developing a burbot bioenergetics model and will determine burbot consumption. Additional studies of the food habits of cormorants have been suggested but to date none have been undertaken.

Growth rates are being followed through changes in relative weight at an 8 inch length and average length at age from index station trawling. Average length at age appears to have been relatively stable since the 1985 year class while relative weight of an 8 inch perch have increased slightly since the 1986-1988 low.

Issues of concern in 1992:

Precise allocation of the yellow perch resource between commercial and sport fishers is not possible. While harvest among commercial fishers is regulated primarily by administration of a poundage quota the sport harvest is regulated primarily through bag limits and seasons. The variability of the sport ice fishery has added increased difficulty in anticipating sport harvest levels. Primarily due to ice and weather conditions, ice harvest estimates varied from 82,154 perch in 1989 to 2,059,510 in 1990, 1,846,062 in 1991 and 529,810 in 1992.

The management strategy and approach to allocating the yellow perch resource will have to be reevaluated in the next management plan.

The interaction of both unwanted exotic and native species in Green Bay is very complex and will at times limit management effectiveness.

Subobjective B.2b: Manage Lake Michigan (outside of Green Bay) to sustain an annual sport harvest of 350,000 - 400,000 yellow perch at 4 fish per pound.

Reviewed by Mike Coshun

Rationale (from the 1986 Plan):

After the crash of the Lake Michigan perch population in 1965, the sport harvest of perch through the 1970's was very low. With the recovery of the perch population in the early 1980's, participation in the perch sport fishery has been increasing geometrically along southeast Wisconsin shores and piers. An annual sport harvest of 350,000 to 400,000 fish would provide perch anglers with hundreds of thousands of hours of enjoyment annually in many of the coastal urban areas, especially in southeastern Wisconsin.

Overview of progress through 1992:

Annual sport harvest of yellow perch in Lake Michigan (excluding Green Bay) has exceeded 400,000 fish each year since 1986. The majority of the sport harvest has been concentrated in the area from Port Washington and south, but recent trends show improvements at northern ports as well.

The rationale is in need of updating. Recent harvest trends and population statistics in Zone 3 indicate that we can raise our expectations of what level of harvest we can safely maintain. We need to place greater emphasis on allocation of the estimated safe level of harvest between sport and commercial fishers. The sport fishery seems capable of tremendous growth in the near future. We need to include a basis for fair division of the available harvest.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Inadequate data base prevents management decisions based on sound biological information.

Tactic: Develop assessment techniques to characterize the yellow perch population and fisheries.

Sampling protocol in Zone 3 has been fully developed and is functioning satisfactorily. Work has begun to develop adequate population surveys for Zone 2.

Tactic: Improve and expand creel census coverage to assess harvest and effort.

We have included yellow perch in our creel survey for Lake Michigan proper since 1986.

PROBLEM 2: Potential for increasing user group conflict increases as the sport and commercial fisheries expand.

Tactic: Develop a management plan to provide information to the user groups.

Presentations on sampling protocol, analysis procedures and management activities have been developed for the public. A formal plan is needed.

Tactic: Develop and implement regulations to resolve user conflicts.

Regulations implemented in 1989 (closed areas and seasonal restrictions on the commercial fishery together with quota management) have resolved many user conflicts. Commercial fishers continue to push for a return to more liberal seasons and quotas. Allocation of the estimated safe harvest between sport and commercial fishers is the greatest remaining hurdle.

Issues of concern in 1992:

The extent to which yellow perch stocks are shared by the four states surrounding Lake Michigan is poorly understood. Regulation of harvest differs among the four states. Impacts of changes in those regulations in one jurisdiction on perch abundance in the other states are unknown at this time.

Interactions between yellow perch and other members of the Lake Michigan fish community are only partially documented. It is generally accepted that in the mid-1960's yellow perch numbers were suppressed by over-abundant alewife. The mechanism for that suppression is still unclear. Obviously, we need to learn more about the interrelationship between perch and alewife and between perch and a whole host of other species.

In recent years a number of unwanted exotic species have been introduced to the Great Lakes including: white perch, zebra mussels, gobies, ruffe, and Bythotrephes cederstroemi. The life history of white perch and ruffe indicates that these species may negatively impact yellow perch abundance.

Yellow perch stocks in the Wisconsin waters of Lake Michigan are shared between commercial and sport fishers. Equitable allocation of the safe harvest is needed.

Objective B.3: Manage the Green Bay walleye fishery to provide an annual sport harvest of 50,000 fish from a population that contains 10 year classes.

Reviewed by Terrence Lychwick

Rationale (from the 1986 Plan):

The reestablishment of walleye populations in the Fox River, Sturgeon Bay, and the west shore of Green Bay has resulted from the stocking of over 1.7 million walleye fingerlings and 28 million fry since 1973. Population estimates for Sturgeon Bay (including its adjacent bays) and the Fox River total nearly 90,000 walleyes 11 inches and larger. Estimates for the west shore of Green Bay have not yet been developed.

While reproduction has been documented in the Sturgeon Bay area, it required the establishment of a minimum of seven year classes of walleye to achieve adequate spawning density. Establishing 10 year classes will increase the probability of successful natural reproduction under favorable conditions.

Successful natural reproduction has not occurred in the Fox River or along the west shore of Green Bay. However, stocking was not initiated in the Fox River until 1977 and large-scale stocking along the west shore did not begin until 1980.

The current annual sport harvest has been estimated at 37,000 walleye from all areas of Green Bay. With a continued stocking program along the west shore and the Fox River and with sustained successful natural reproduction in Sturgeon Bay, it is felt that a total harvestable population of 150,000 walleyes in the waters of Green Bay can be achieved by 1991. Allowing for an annual exploitation rate not exceeding 35 percent, an annual harvest of 50,000 walleye can be expected.

Overview of progress through 1992:

Walleye are a native top predator in the Green Bay fish community and are recognized in the Fox River/Green Bay Remedial Action Plan (RAP) as important for developing a balanced fish community. Discrete populations exist in the Sturgeon Bay vicinity, inner Green Bay (including the Fox River) and the Menominee River. Less abundant but valuable populations utilize the mid-bay east shore region and west shore rivers during the spawning period. All populations, with the exception of the Menominee River, were established by the stocking of 1.7 million fingerling and 28 million fry from 1973 through 1984. No walleye have been stocked in Wisconsin waters of Green Bay since 1984. Natural recruitment, although highly variable, has been documented in the Fox River since 1985 and as early as 1980 in the Sturgeon Bay region. Less is known about recruitment success of the east and west shore populations.

The 1991 annual sport harvest has been estimated at approximately 5,000 walleye from all

areas of Green Bay. Since 1986 the harvest has averaged over 15,000 walleye annually ranging from a low of 3,000 in 1989 to over 35,000 in 1986. Although the reduction in harvest is dramatic, almost all of it is due to a seasonal bag and size limit change on the Fox River aimed at protecting the population from excessive exploitation. Prior to implementation (1989) the average annual Green Bay harvest was approximately 25,000 walleye. During this same period the Fox River-Brown county harvest averaged 20,000 walleye. Since 1989 the Fox River-Brown county harvest has ranged between 1,100 to 1,600 walleye annually.

Conservative population estimates for the Sturgeon Bay area plus the Fox River/Inner Bay averaged 50,000 walleye during the 1986-1991 time period. Maximum total exploitation rates between 35 percent to 37 percent allow for a total removals (sport harvest + incidental catch mortalities) of between 17,500-18,500 walleye. Within the commercial fishery, monitoring of the incidental catch derived estimates of walleye mortalities which did not exceed 10,000 walleye annually (1984-1986 estimates ranged from 9,446 in 1984 decreasing to 1,693 by 1986).

Based on current sport harvest estimates and anticipated incidental mortalities in the commercial fishery, total exploitation rates appear to be within a safe range.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Current harvest levels have been achieved through maintenance stocking and additional walleye fingerlings are not available.

Tactic: Continue maintenance stocking by increasing production, purchase, or reallocation from inland commitments.

Throughout the 1980's additional walleye fingerling production sufficient to effectively stock Green Bay was unavailable. Furthermore, natural recruitment had been documented in the Sturgeon Bay area and within the Fox River spawning densities and available mature year classes appeared sufficient for successful reproduction. Because of the lack of fingerlings and the potential successful reproduction, the decision was made to cease stocking of walleye effective in 1985. This decision allowed for measurement of natural recruitment and determining if stock size can be sustained within those levels of recruitment.

Tactic: Limit the harvest to a level consistent with natural reproduction.

Excessive exploitation rates of the Fox River population led to a very restrictive regulation change reducing the bag limit and increasing the size limit on a seasonal basis. This action substantially reduced the total annual exploitation rate.

Tactic: Monitor the Green Bay commercial fishery and determine the extent of the incidental harvest.

Extensive monitoring of the commercial perch fishery was conducted between 1984-1987. Both the incidental catch of walleye and the handling mortalities associated with the perch harvest were developed. As perch abundance increased during this period the corresponding catch rates in the commercial fishery increased. This led to a decrease in the total effective effort required to catch a given level of harvest quota which in turn led to a decrease in the total numbers of walleye handled.

Tactic: Continue a creel census of the walleye fishery to estimate the sport fishing harvest.

The 1986 Great Lakes creel census redesign has provided estimates of the walleye harvest and angler pressure. With the exception of 1988 these estimates, however, do not include the walleye harvest which is occurring during the night time hours. In some areas (i.e. Sturgeon Bay) this may be a significant portion the total harvest for that location.

PROBLEM 2: The extent of natural reproduction has not been determined for all Green Bay populations.

Tactic: Continue evaluation of reproductive success in the Sturgeon Bay area.

Measuring recruitment in the Sturgeon Bay area is dependent on spawning surveys measuring the abundance of three year old males as they mature. Fall electrofishing surveys have not proved effective in determining the presence of young of the year walleye even during those years when extensive fingerling stocking was done.

Tactic: Continue assessments which will identify natural reproduction in the Fox River and along the west shore of Green Bay.

Assessment surveys have been conducted along the east shore of Green Bay, the Fox River and within Sturgeon Bay. All locations have shown evidence of natural recruitment of walleye. Minimal effort has been conducted along the west shore of Green Bay primarily because of budgetary constraints.

Tactic: Determine the abundance of naturally reproduced year classes.

Relative year class strengths of three year old walleye entering the spawning population have been established for five naturally recruited year classes of the Fox River population and eight year classes within the Sturgeon Bay population. Fall fingerling indices of abundance have been determined for five and four year classes for the Fox River and east shore populations, respectively.

Issues of concern in 1992:

While natural recruitment has been consistently documented for all walleye populations in Green Bay, the level of recruitment has varied substantially. The broad range in recruitment level is most evident in the Sturgeon Bay population. Survival of natural recruited year classes to spawning age has varied by two orders of magnitude (100 x). Although in some years natural recruitment has equalled or exceeded those years when fingerlings were stocked, the frequency of these strong year classes has yet to be determined. By comparison the Fox River population has a much narrow range of variation. Recruitment (as measured by survival to spawning age) has varied by only a factor of three to five.

Although wide variance in recruitment is common in naturally sustained populations, the fluctuations in walleye abundance due to these differences has led to dissatisfaction with walleye catch rates on the part of some anglers. These anglers expectations are high because they became accustomed to elevated population levels achieved by forced recruitment through stocking of walleye fingerling. Some are suggesting that we begin a maintenance stocking program to raise walleye abundance, achieve higher catch rates and, by doing so, meet angler expectations.

Maintenance stocking may work at cross purposes with other management goals. There may be an impact on other species due to forced recruitment of walleye (i.e. smallmouth bass). There will be trade-offs.

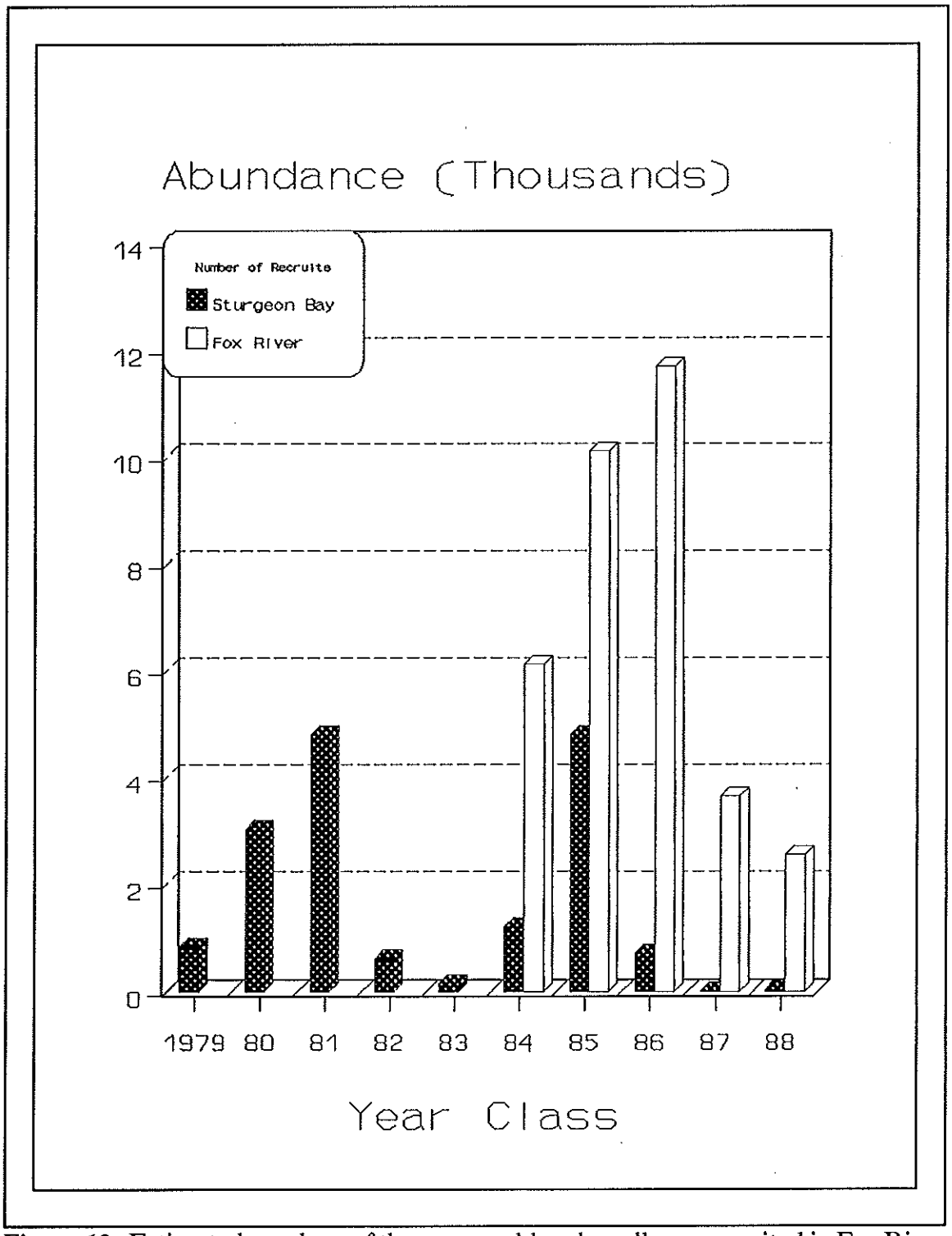

Figure 12. Estimated numbers of three-year-old male walleyes recruited in Fox River and Sturgeon Bay areas, 1979-1988.

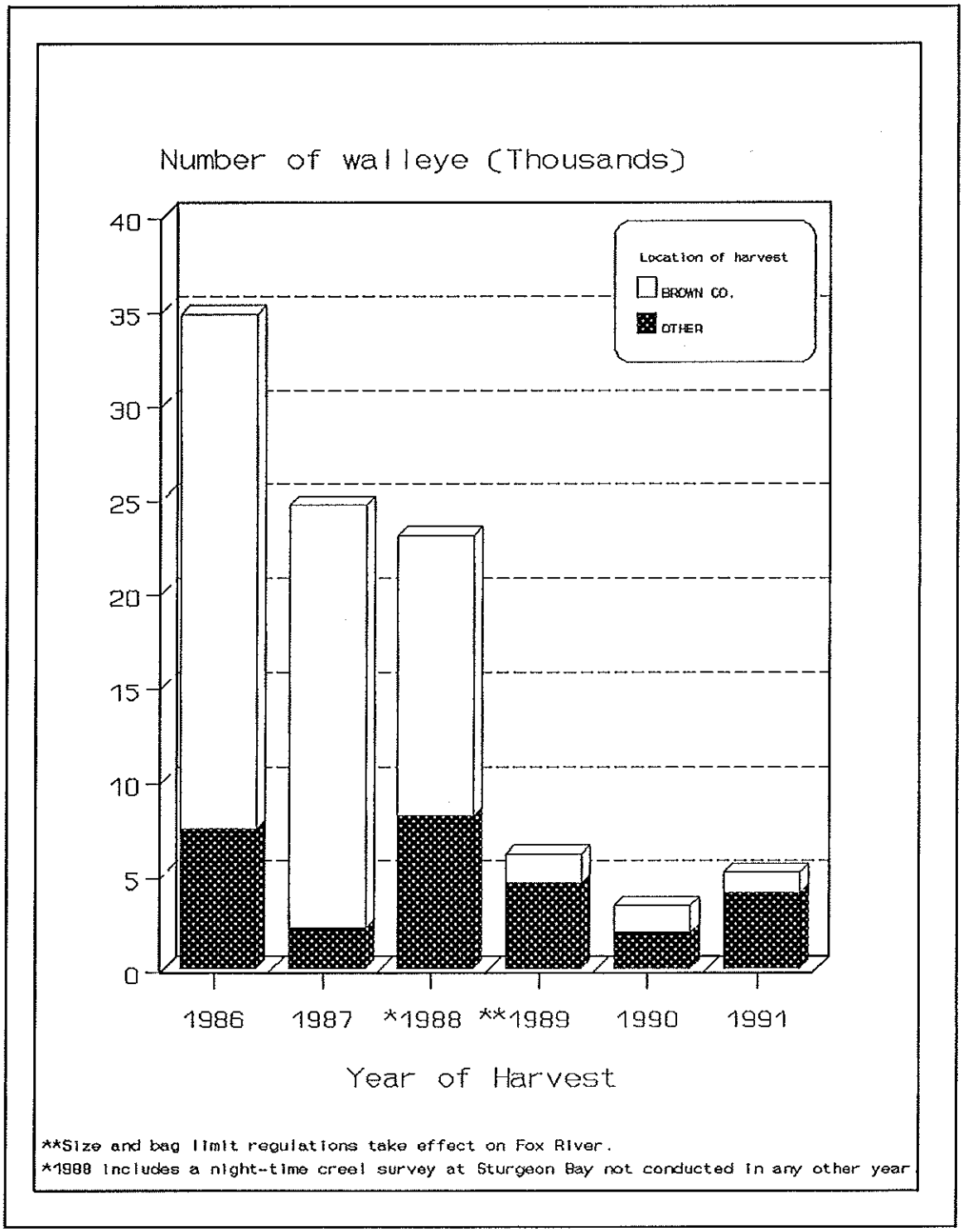

Figure 13. Annual sport harvest of walleye in Brown County and elsewhere in Green Bay, 1986-1991.

Objective B.4: Maintain the angling opportunities at the current level for the remaining sport species until their population status can be determined.

Reviewed by Terrence Lychwick

Rationale (from the 1986 Plan):

Limited data on species like smallmouth bass, northern pike, rock bass, white bass, catfish, crappie, bullhead, and muskellunge preclude our ability to set meaningful objectives for them. Until further studies on these species are conducted, our objective must be to maintain the angling opportunities for them at current levels.

Overview of progress through 1992:

The 1986 creel survey re-design allows us to evaluate the sport harvest and effort directed toward the diverse fish community common to Lake Michigan and Green Bay. These data have provided us with information on species of regional importance to the sport fishing community. Tagging studies have also shown that although some species exhibit movement behaviors that are quite restricted many others exhibit a widely ranging behavior. The information from the creel survey and tagging studies implies that determining the population status for some species may require extensive surveys over a wide geographic area. These surveys would be extremely expensive, particularly if time series or trend data was required.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Population data for smallmouth bass, northern pike, white bass, muskellunge and lake sturgeon is inadequate.

Tactic: Initiate population studies for the above species.

Base line information has been collected on many species within narrow geographic regions. Budget restraints make it difficult if not impossible to do broad based surveys.

PROBLEM 2: Loss of spawning habitat through shoreline development may be occurring.

Tactic: Document critical spawning habitats.

To some extent, for local populations, spawning habitats have been identified. However, for the wide ranging, cosmopolitan species critical spawning areas have not been identified.

Tactic: Re-evaluate our input into Chapter 30 permits.

As a practical matter, the process of our input in permit reviews has not changed a great

deal. Although in recent years the remedial action planning process has focused attention in this area, the degree to which Fisheries Management has input will vary with the workload of Water Regulation and Zoning and their required turnaround time.

PROBLEM 3: Access may be a limiting factor in providing fishing for certain species.

Tactic: Construct fishing piers.

Shore fishing and full access sites have been developed at many locations along Lake Michigan and Green Bay including: Bayview Park, Stone Quarry, Fox River Lumber, etc.

Tactic: Secure funding sources to purchase access points.

Fish Restoration Act funds provide the primary vehicle for development of access sites while state funds (Steward) are primarily used for acquisition of real estate.

Issues of concern in 1992:

Inadequate funding will continue to limit the ability to obtain timely and accurate data on the wide variety of species which may require management decisions. Without complete information on these species, this position dictates protective, conservative decisions and regulations. By following this policy, while not necessarily reducing angling opportunities, there can be reductions in harvest opportunities for sport anglers (i.e. instituting a size limit for smallmouth bass and increasing the minimum size limit on muskellunge).

Objective C.1: Produce a naturally reproduced year-class of lake trout that is detectable at the yearling life stage.

Reviewed by Mark E. Holey

Rationale (from the 1986 Plan):

Criteria based on population parameters were established to compare the rehabilitation potential of lake trout populations that develop from various management strategies. The criteria chosen were based on the characteristics of naturally reproducing, self-sustaining lake trout populations elsewhere in North America. Satisfaction of the following criteria should provide a naturally reproduced year-class of lake trout that is detectable at the yearling life stage:

1. An annual total mortality rate not exceeding 40 percent for the first 12 age classes;

2. A Minimum of 7 mature age classes;

3. A spawning density of 4 mature lake trout per acre of spawning reef;

4. A minimum annual deposition of 3,000 fertilized eggs per acre of spawning reef.

The annual total mortality criteria was based on a review of mortality rates reported for populations across North America. Criteria 2 through 4 were based on data from the Lake Superior lake trout population that uses Gull Island Shoal as a spawning reef.

A simulation model has been developed for geographically specific zones within the Wisconsin waters of Lake Michigan (Figure 9). The zones were established based on differences in past stocking levels, sport and commercial catches, and the availability of spawning reefs (Table 3). The Kenosha-Kewaunee zone encompasses the area where the majority of lake trout sport angling occurs. The Mid-Lake zone includes an area of Lake Michigan that contains an extensive deep water reef area thought to provide some of the most productive spawning grounds in Lake Michigan that contains an extensive deep water reef area thought to provide some of the most productive spawning grounds in Lake Michigan. The Clay Banks zone includes reef areas where more than one half of the lake trout stocked (1980-1982) in the Wisconsin waters of Lake Michigan have been placed.

Overview of progress through 1992:

There has been no clear evidence of natural reproduction of lake trout in Wisconsin waters of Lake Michigan. In the Midlake Refuge there was an increasing trend of unclipped lake trout from summer assessment gill net surveys, but that trend has not been seen from fall assessment gill net surveys. Lake trout rehabilitation was refocused in 1985 with the approval of a interagency lakewide restoration plan and its management recommendations. The impacts

of those strategies implemented in 1985 will not be adequately evaluated until the year 2003.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: An insufficient number of lake trout eggs are being deposited on ideal spawning substrate.

Tactic: Develop an egg-taking operation or a brood stock as naturally produced lake trout begin to mature to enhance egg production.

Since no naturally produced fish have been detected, and egg-taking operation has not been developed. A broodstock of Green Lake strain lake trout was developed from fish collected from Lake Michigan near Milwaukee. The Green Lake strain was one of the strains designated for the Midlake Refuge, but had been missing from the federal hatchery system. In 1992 the Midlake Refuge will receive a full quota of Green Lake strain for the first time.

Tactic: Map the spawning reefs designated for rehabilitation to identify ideal spawning substrate so that fish and egg planting can be made over the most ideal substrate.

Bathymetric charts have been completed for the Sheboygan Reef, Clay Banks Reef, and Whitefish Point Reef. The chart for Clay Banks also includes substrate composition that has been verified by underwater video and diving. Data for the Jacksonport Deep Reef has been collected but not summarized in chart form.

PROBLEM 2: Knowledge of the relationship between micro-contaminant levels and early-life

Tactic: Monitor micro-contaminant levels in lake trout closely, and periodically describe the survivability of eggs taken from Lake Michigan fish.

Contaminant levels in lake trout have been monitored and the survivability of lake trout eggs from Lake Michigan was measured in 1987,89,90,and 91. Total PCB levels in all sizes of lake trout have decreased significantly. The survivability of Lake Michigan lake trout eggs from fertilization to swim-up was less than in Lake Superior but not low enough to be a major reason for the lack of reproduction.

PROBLEM 3. It is difficult to detect young naturally reproduced lake trout.

Tactic: Develop and utilize techniques for detecting naturally reproduced lake trout at an early life stage.

A small mesh gill net survey has been established in the Clay Banks area to assess the

relative abundance of two year old lake trout. To sample lake trout at an earlier age would require the use of trawls. The Department lacks trawling capability on Lake Michigan.

PROBLEM 4. Public support for the lake trout rehabilitation plan is weak.

Tactic: Provide regular reports to user groups to keep them informed.

Annual reports have been prepared for the Great Lakes Fishery Commission. Regular reports targeted for the user groups have not been prepared. A number of oral presentations have been made, however.

Issues of concern in 1992:

The rehabilitation of lake trout in Lake Michigan remains a very important goal. The multi-agency lakewide management plan that was approved and implemented in 1985 resulted in significant changes in lake trout stocking procedures and harvest regulations. The effectiveness of those changes will not be fully measurable until the year 2003. It has been hard to keep public support for lake trout restoration focused because of the length of time between implementation and evaluation of the program. Improved communication and involvement of the public in the lake trout restoration effort would be beneficial.

Subobjective C.1a: Manage fisheries mortality of lake trout to provide an average annual mortality of not more than 40 percent lakewide.

Reviewed by Mark E. Holey

Rationale (from the 1986 Plan):

See rationale for C.1.

Overview of progress through 1992:

The 40 percent total mortality goal has been achieved only in the Clay Banks Reef area. The mortality rate in recent years at Manitowoc and Milwaukee has ranged from 50-68%. Reliable estimates of mortality in the Midlake Refuge have yet to be made.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: Too many lake trout are bring removed by sport and commercial fishers to maintain a less-than-40-percent annual mortality.

Tactic: Reduce lake trout removal by commercial and sport fisheries.

A series of both sport and commercial regulations have been implemented to limit the total kill of lake trout at the target goals. A refuge was created to protect the fish being stocked on the midlake reefs. The first refuge created in the midlake reef area was on the Sheboygan Reef in 1980 that prohibited sport and commercial fishing in water 180 feet and shallower, an area of about seven square miles. The boundaries have been increased several times since then. The final enlargement of the Midlake Refuge in April 1989, which encompassed an area over 560 square miles, provided protection to all four midlake reefs from sport and commercial fishing.

The increasing sport harvest of lake trout from Lake Michigan in the early 1980's, prompted the Department to implement new regulations on the sport fishery to insure the abundance of lake trout would increase. In 1986 the Department changed the continuous open season on lake trout to a May 1 to Labor Day season, lowered the daily bag limit from 5 to 2, and created a refuge between Sturgeon Bay and Algoma that was closed to lake trout sport fishing and all commercial fishing. The refuge is triangular in shape with the apex in the lake defined by the intersection of a line running 135^0 from the Sturgeon Bay Ship Canal and a line running 90^0 from the Algoma harbor. The triangle extends out into the lake approximately 17 miles on a side.

In 1989, the Department implemented a very comprehensive rule package for the commercial fisheries in Lake Michigan. For the Clay Banks Primary Zone it meant the elimination of all commercial fishing from Baileys Harbor to Kewaunee except for

entrapment gear for lake whitefish from Whitefish Bay to Baileys Harbor in September and October and small mesh gill nets for chubs in water greater than 45 fathoms (270 feet) in an area running 6 miles north of the Kewaunee line. To address concern of incidental kill of lake trout and chinook salmon from the developing commercial gill net fisheries for chubs and perch, the Department enacted a rule in October 1986 that required the use of low profile gill nets in waters less than 150 feet deep. The Department opened up the period from January 15 to March 1 for chub fishing in April of 1989, but required the nets to be fished in depths of 360 feet or greater to lessen the impact on lake trout.

PROBLEM 2: Lamprey continue to prey on lake trout and could become a limiting factor.

Tactic: Continue our support of the lamprey control program at the 1981-83 level or better.

The state of Wisconsin has continually supported the sea lamprey control program of the Great Lakes Fishery Commission. The sea lamprey program has been experiencing funding shortfalls in recent years. Wisconsin has gone on record with the State Department as supporting the budget initiatives for the control program.

PROBLEM 3: Present number of assessment surveys are inadequate to measure the mortality rate lakewide.

Tactic: Conduct lake trout assessment surveys in representative areas lakewide in a consistent format, to collect adequate population data to determine mortality rates and spawning densities.

A "Lake Michigan Lake Trout Assessment Plan" was produced that outlines the lake trout assessment needs and procedures for Wisconsin. As a result the number of surveys were increased to the target levels for several years. Those surveys included a spring pound net at Sturgeon Bay; summer gill nets at Cana Island, Clay Banks, Manitowoc, Milwaukee, and the four reefs in the Midlake Refuge; fall gill nets at Clay Banks, Milwaukee, and the Midlake Refuge; and spring gill nets near Clay Banks for juveniles. Recently funding constraints have eliminated the gill net surveys at Cana Island and Manitowoc, and the spring pound net survey in 1991.

Issues of concern in 1992:

Significant sport and commercial harvest regulation changes for lake trout have been implemented since the completion of the Lake Michigan Fisheries Management Plan in 1986. Positive results in spawning lake trout abundance have been measured. However, those positive trends may be changed by a series of events that have occurred. As mentioned in

earlier objectives the numbers of lake trout actually stocked since 1985 have not equalled the stocking goals. The abundance of lake trout outside of the Clay Banks area and the Midlake Refuge will probably decrease because of the lack of stocking in those areas unless large numbers of lake trout migrate in from other areas. The collapse of the chinook fishery in 1988 will probably increase the harvest of lake trout to make up for the loss of the salmon. Lamprey control remains vital for lake trout restoration and even the sport fishery to succeed. Developments in 1992 may result in a drastic cut in funds. If significant cuts are made in the treatment schedule for Lake Michigan, there would be major impacts on the mortality of lake trout.

The level of funding for lake trout restoration has declined in recent years causing several assessment surveys to be dropped. Because lake trout restoration requires such a long time frame it is important that adequate surveys be conducted to evaluate the progress of the program. If the financial support for the lake trout program drops much lower than the 1991 levels, it will begin to affect our ability to adequately evaluate progress toward restoration.

Subobjective C.1b: Develop lake trout populations in two primary rehabilitation areas that exhibit seven mature age classes, and either:

1. An October spawning density of 4 trout per acre of spawning reef, or

2. An annual egg deposition of 3,000 fertilized eggs per acre of spawning reef.

Reviewed by Mark E. Holey

Rationale (from the 1986 Plan):

See rationale for C.1.

Overview of progress through 1992:

Based on fall spawning surveys seven mature age classes have been developed in the reef areas near Clay Banks and Milwaukee. The age classes on the midlake reefs have also increased because of stocking, but because the fish mature later than fish nearshore, there are not seven mature age classes yet. Difficulties in estimating the actual number of lake trout during spawning, the number of eggs they deposit, or the acreage of suitable spawning habitat have prevented the measurement of spawning densities. The fall spawning surveys do allow a relative comparison of density by comparing the catch rate (no. per 1000' of net) of lake trout. The fall surveys show that densities of lake trout have increased significantly since 1985 at both Clay Banks and Milwaukee. The catch rate of lake trout during spawning has increased at Clay Banks from around 58/1000' in 1985 to 150/1000' in 1991. Near Milwaukee the catch has increased from near 60/1000' in 1985 to around 140/1000' in 1991.

Assessment of tactics (problems and tactics from 1986 Plan in boldface):

PROBLEM 1: There inadequate number of mature lake trout spawning on suitable reefs.

Tactic: Stock lake trout with rehabilitation as the main objective and with harvest as a secondary objective.

Stocking since 1985 has been directed to those areas that have the best chance to realize natural reproduction. The regulations that have been implemented and described for objective C.1a for lake trout are more restrictive than for the other trout and salmon species and supports this tactic.

Tactic: Stock lake trout over ideal spawning habitat instead of from shore.

Since 1985 all lake trout have been stocked by boat over traditional spawning reefs.

Tactic: Investigate whether stocking lake trout at earlier life stages than the yearling

stage would result in better homing of those fish as adults.

A project to evaluate the technique of stocking lake trout eggs over spawning habitat in astroturf incubators was conducted in 1988 and 1989. The project was conducted cooperatively with a group of commercial fishers from Algoma and Door County. A total of 2.6 million eggs were stocked on an offshore reef near Jacksonport over the two years. Hatching did occur but it is too early to determine how many have survived past hatching.

Tactic: Construct an artificial spawning reef.

No work has been done on this tactic, although it has been proposed to see if an artificial reef built at Clay Banks might stimulate reproduction.

Tactic: Determine locations of all suitable spawning reefs.

A considerable amount of work has been completed in this area. Egg and fry traps have been used over several years in the Clay Banks area to determine where the lake trout where depositing their eggs. Extensive diving surveys have also been conducted to locate suitable spawning habitat. The DNR has worked cooperatively with the U.S. Fish and Wildlife Service to conducted sidescan sonar and underwater video surveys of Clay Banks and other potential spawning sites. All the work to date has failed to locate areas where deposition occurs. There is a lot that needs to be learned before we can accurately describe what suitable lake trout spawning habitat is in the Great Lakes.

PROBLEM 2: The strain of lake trout stocked may be inappropriate for rehabilitation in Lake Michigan.

Tactic: Begin to stock and evaluate the performance of the following lake trout strains as recommended by the Lake Trout Technical Committee: Lake Superior domestic, Gull Island Shoal and domestic cross, Wyoming strain, Green Lake strain, and Seneca strain.

Since 1985 the federal hatchery system has produced a number of lake trout strains that have been stocked in Lake Michigan. The disease problems that the hatcheries encountered limited their ability to produce the number of strains that were called for by the lakewide management plan. Most of the special strains have been stocked in the lakewide refuges at Beaver Is and midlake reefs. In recent years nearshore areas in Wisconsin have been receiving more than the traditional Marquette strain.

Issues of concern in 1992:

Habitat selection by hatchery reared lake trout in Lake Michigan is not well understood. In recent years more research has been centered on this topic with promising results. Additional

work is needed to determine where all the spawning lake trout at Clay Banks are depositing their eggs. Constructing an artificial reef in the Clay Banks area would provide an opportunity to explore some of the hypothesis as to why natural recruitment has not occurred.

All the lake trout strains stocked in the Midlake Refuge have been microtagged. To properly evaluate the performance between strains, special attention needs to be placed on evaluating the microtag returns from all lake trout sampled.

One of the more promising techniques for lake trout restoration is planting lake trout eggs in artificial turf incubators. A project to evaluate the effectiveness of the egg planting in Lakes Michigan and Huron has been approved and implemented. The project calls for alternately stocking 4 million eggs per year between Lakes Michigan and Huron, to begin in 1992. The evaluation of this technique will require 10-15 years and a strong commitment from the agency.

MASTER